Chemical Age

CHEMSTRAND'S NEW ACRILAN PLANT
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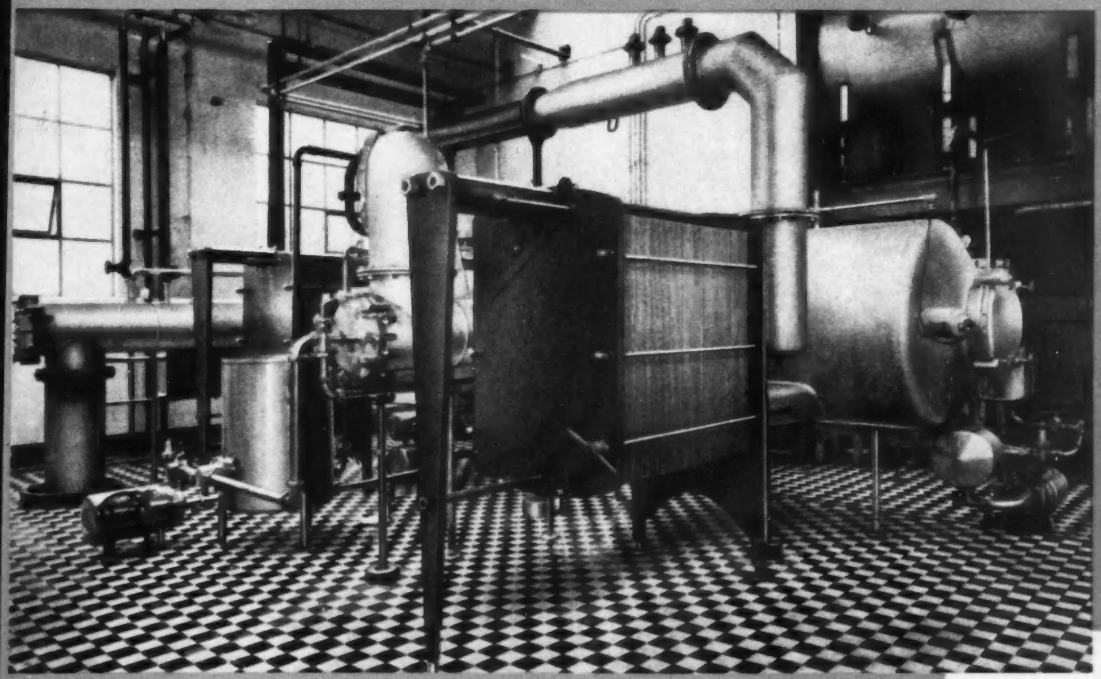
VOL. 81 No. 2069

7 March 1959

AN OUTSTANDING DEVELOPMENT IN EVAPORATION



APV Double Effect Plate Evaporator with thermo-compression at the Uttoxeter Condensory of Wilts United Dairies Ltd.

The APV Plate Evaporator has aroused considerable interest as a continuous evaporating unit of new and revolutionary design.

By using plates on the climbing and falling film principle, instead of tubes, a very simple and compact evaporator results that requires under nine feet of headroom. The saving in first and installation costs is appreciable.

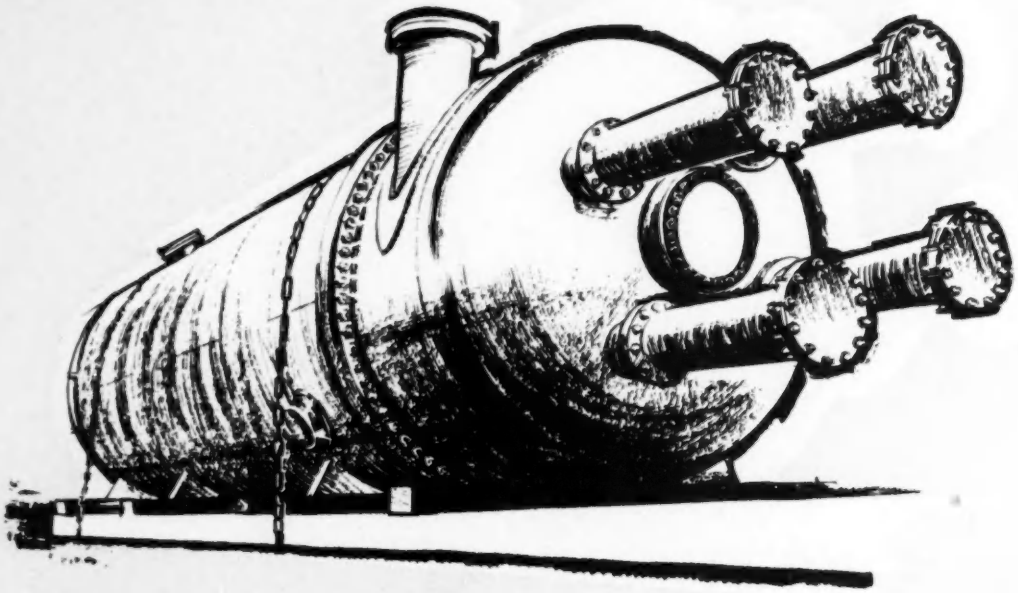
A number of APV Plate Evaporators are already in very successful operation on milk and fruit juices. This type of evaporator is equally applicable to a wide range of other duties and has pronounced advantages for many, particularly for heat sensitive liquids.

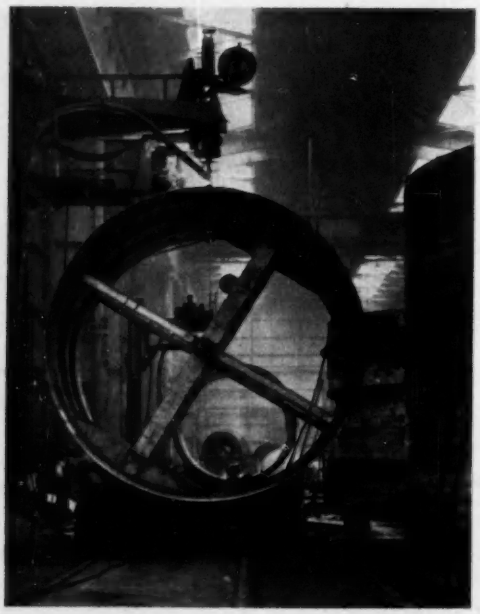
Overall cost is lower.
Height under 9 feet.
No supporting steelwork needed.
One-level operation.
Two controls only.
Capacity readily altered.
Fully accessible for cleaning.
Extremely low product hold-up.
Ideal for heat sensitive liquids.

APV PLATE EVAPORATOR

THE A.P.V. COMPANY LTD., MANOR ROYAL, CRAWLEY, SUSSEX
TELEPHONE: CRAWLEY 1360 TELEX: 8737 TELEGRAMS: ANACLASTIC, CRAWLEY

QUALITY ENGINEERING





Continuous welding of a section of a 16' dia. stainless steel vessel.

The works division of the company specialises in the design and fabrication of pressure vessels to all grades for the chemical and petro-chemical industries in all weldable alloys including clad material.

Limitation as to size and weight is governed only by transport arrangements but full facilities for site erection can be provided.

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ASSOCIATED WITH **THE POWER-GAS CORPORATION LIMITED**

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378 AUSTRALIA · CANADA · INDIA · FRANCE · SOUTH AFRICA

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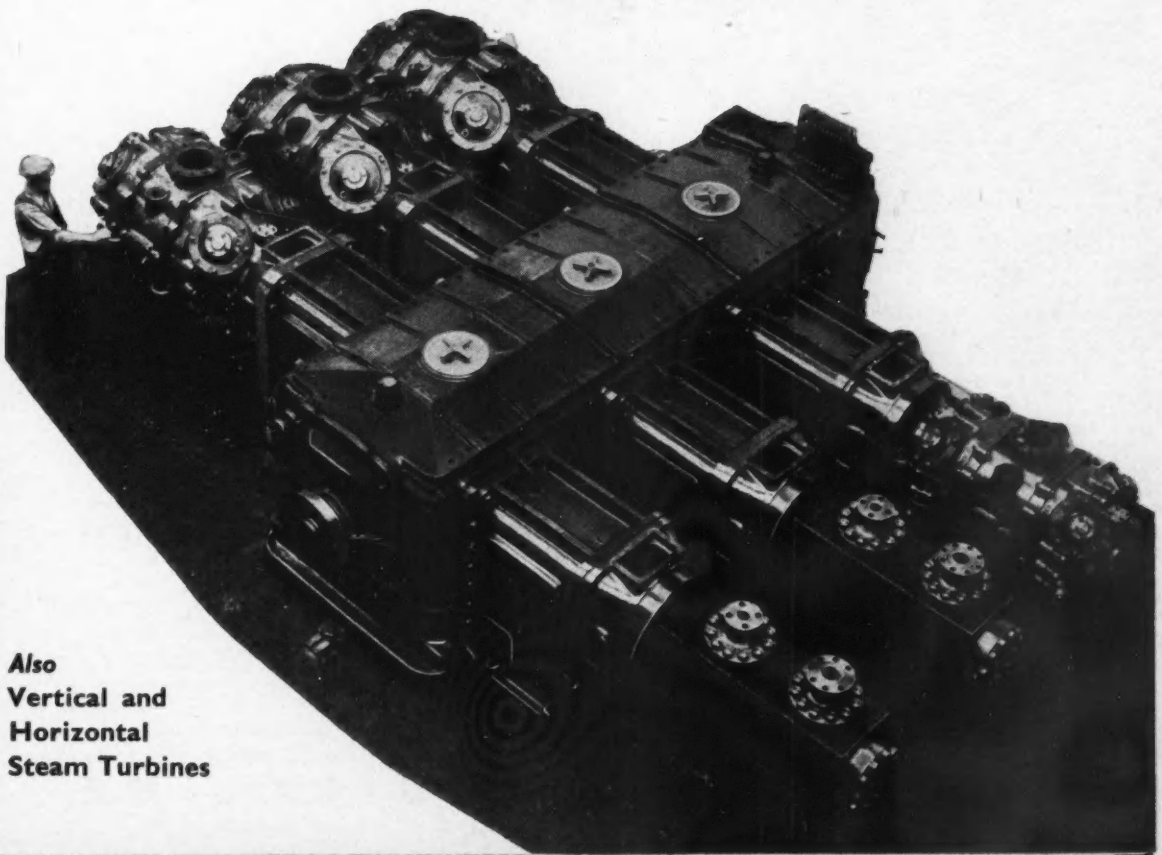
AIR & GAS COMPRESSORS

MADE TO MEASURE TO INDIVIDUAL'S EXACT REQUIREMENTS



Also
Vertical and Horizontal Steam Turbines

PETER BROTHERHOOD
PETERBOROUGH ENGLAND

COMPRESSOR & POWER PLANT SPECIALISTS FOR NEARLY A CENTURY

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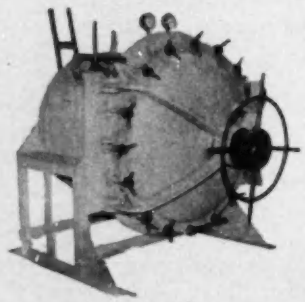

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By Permutit

A complete range of "Zeo-Karb 225" and "De-Acidite FF" ion exchange resins for chromatographic separations and other analytical purposes is now being produced by The Permutit Company Ltd. A new production unit has been established especially for this purpose. Details of the resins are as follows :—

"ZEO-KARB 225"

% DVB.	Water Regain grams of water per gram of Na resin	PARTICLE SIZES
1	6–12	14–52, 52–100, 100–200, < 200
2	3–5	14–52, 52–100, 100–200, < 200
4.5	1.5–2	14–52, 52–100, 100–200, < 200
8	0.9–1.1	14–52,* 52–100, 100–200, < 200
20	0.4–0.6	14–52, 52–100, 100–200, < 200

*Standard "Zeo-Karb 225"

"DE-ACIDITE FF"

Water Regain grams of water per gram of Cl resin	PARTICLE SIZES
1.6–2.0	14–52, 52–100, 100–200
1.0–1.5	14–52,* 52–100, 100–200, < 200
0.6–0.9	14–52,** 52–100, 100–200, < 200

*Standard "De-Acidite FF" type 510 **Standard "De-Acidite FF" type 530

The crosslinking of "Zeo-Karb 225" cation exchange resins is given in terms of nominal weight percentage of divinylbenzene in the hydrocarbon polymer. The corresponding weight swelling or water regain is also given.

Only the weight swelling, or water regain, is specified for the "De-Acidite FF" because extra crosslinks, in addition to those originally placed in the hydrocarbon structure, are introduced during manufacture. It is thus not possible to produce "De-Acidite FF" in as wide a range as "Zeo-Karb 225" because materials with very high water regain are difficult to manufacture reproducibly.

For further details please write to :—

THE PERMUTIT COMPANY LIMITED

Dept. V.A. 299 . Permutit House, Gunnersbury Avenue, London, W.4 . Telephone: CHIswick 6431

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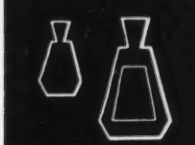

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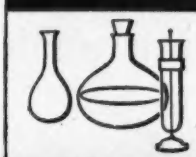

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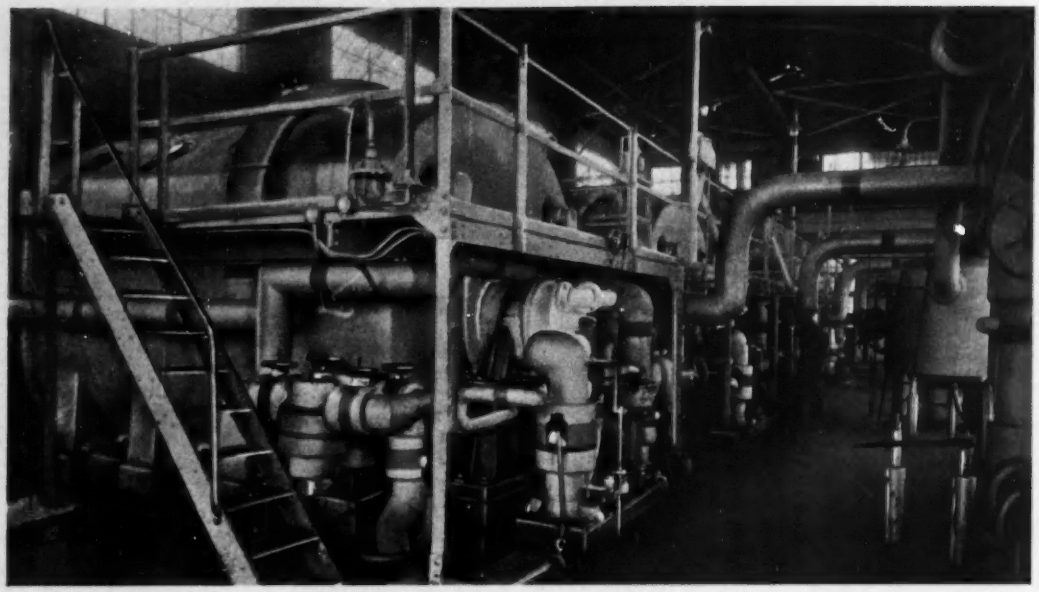

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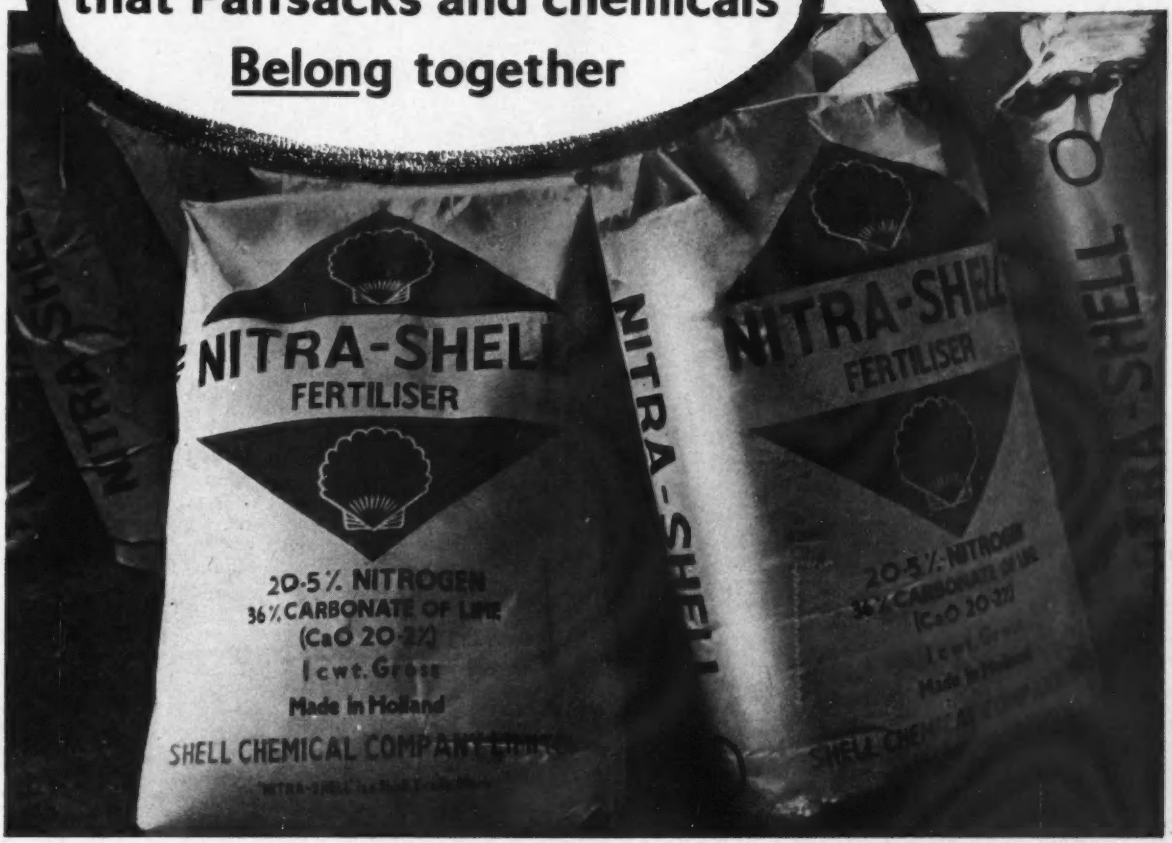

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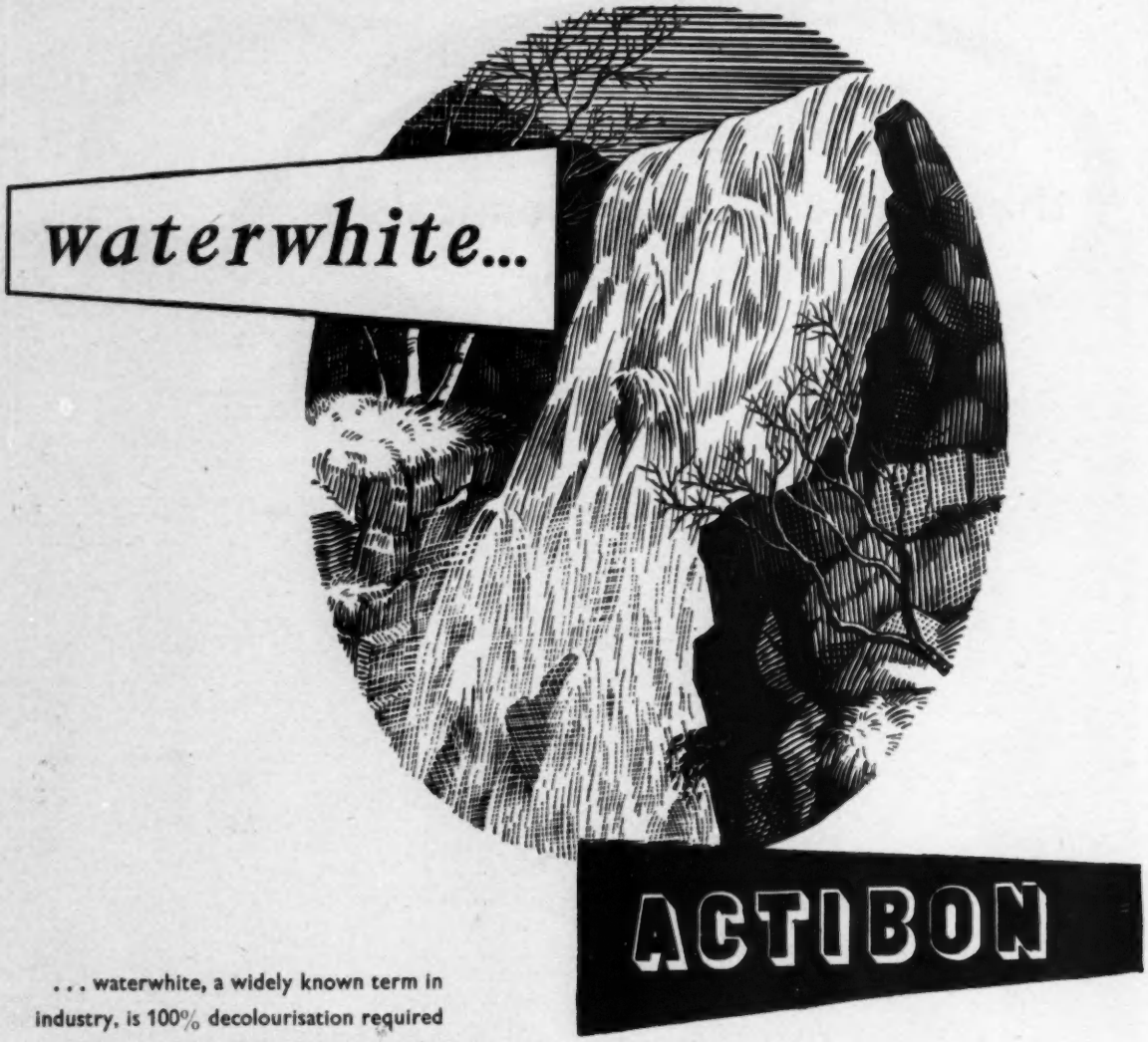

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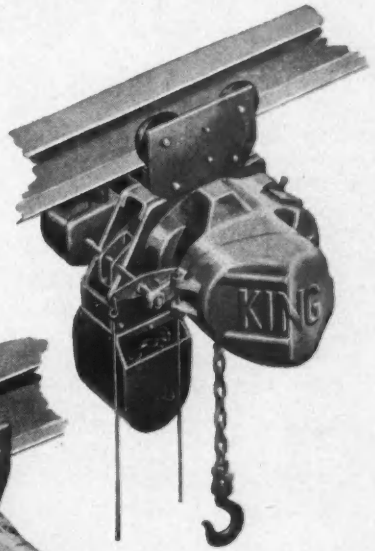

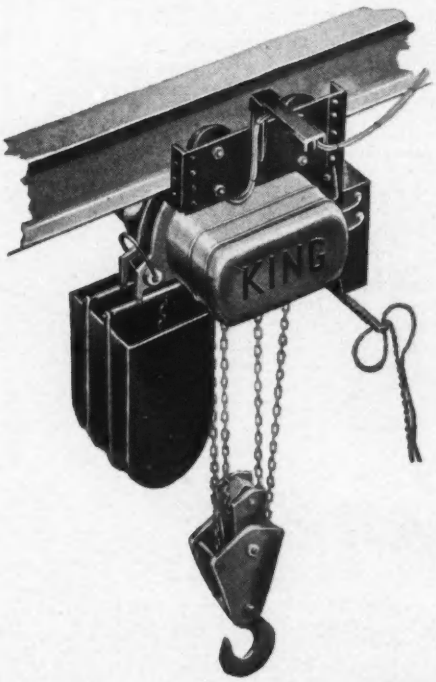

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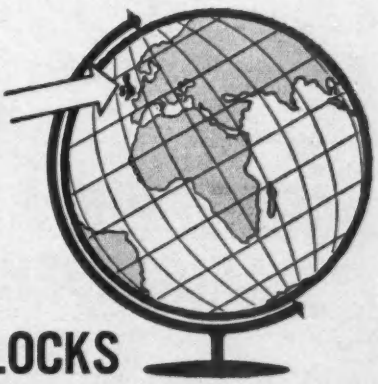

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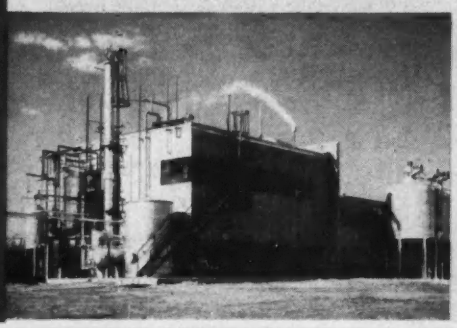

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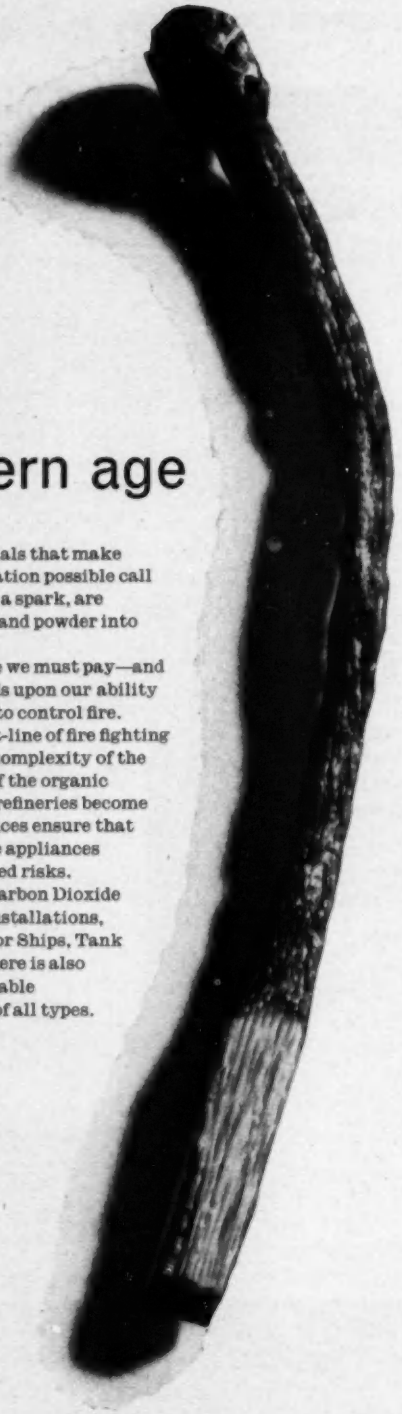

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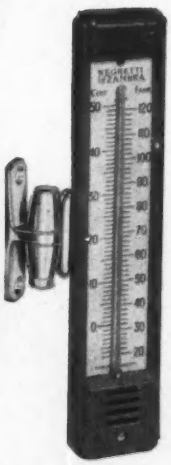

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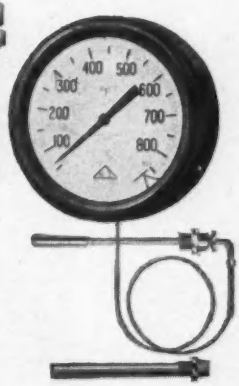

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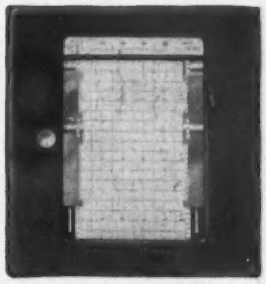

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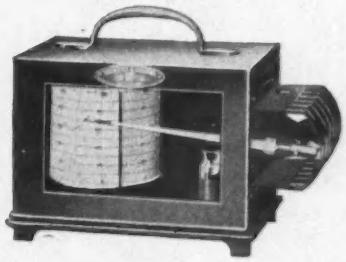

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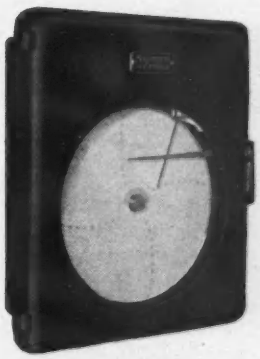

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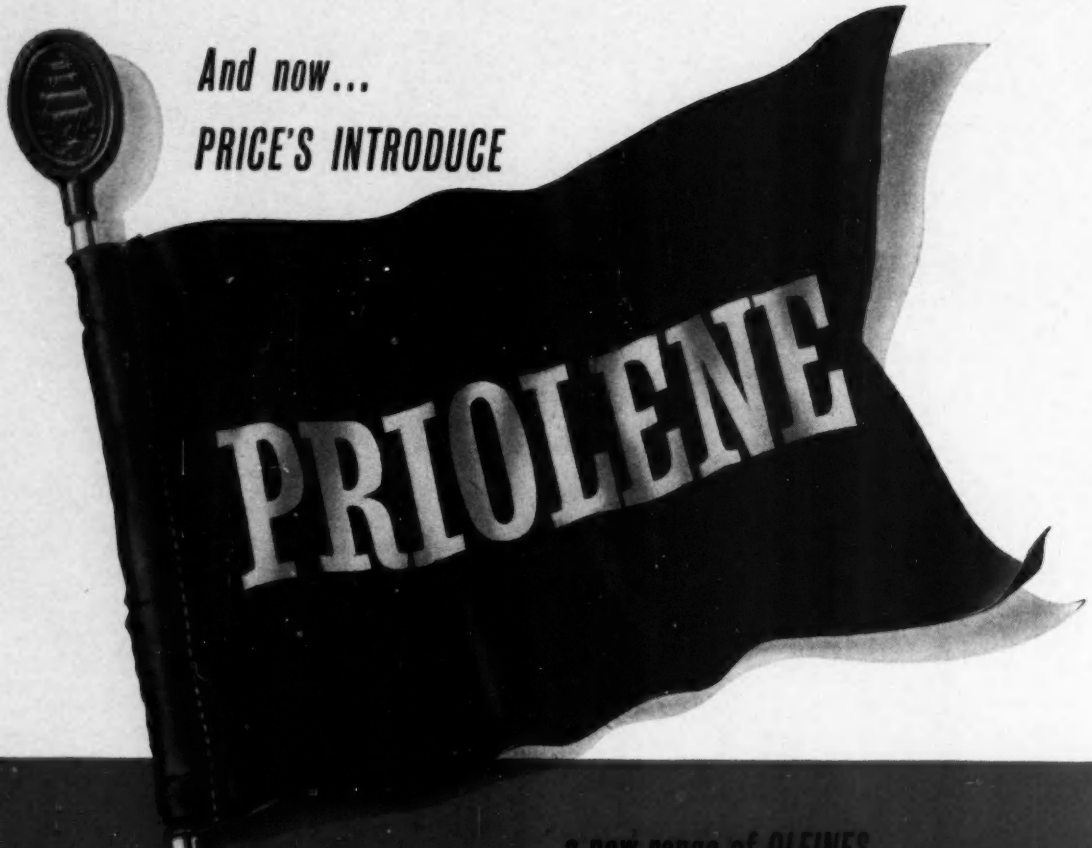

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CHEMICAL AGE

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TOO MUCH SECRECY

THE British chemical industry is notoriously secretive about its new developments, whether these involve a new process, a new plant project, a major contract landed, a research breakthrough, or even a new product or an overseas visit by an executive. Few of these developments escape the attention of CHEMICAL AGE, but in a great many cases information is not available beyond the bare facts.

Hence reference to major achievements is often carried in only a few lines when it should be blazoned in headlines. Each week major-interest stories have to be played down and it has become extremely difficult for the technical press to highlight the achievements of British chemists and chemical engineers and the industry they work in. This is a pity for publication of such news would take throughout the world the message that U.K. chemical manufacturers are among the most progressive.

For reasons that are easy to discover but difficult to understand, most companies prefer to draw a veil over their achievements. Basic reason is the fear that publicity would give vital information to competitors, a fear that in most cases is unfounded for when information is refused to the press it is frequently already widely known in industry.

To show the futility of this policy, which occasionally amounts to blatant censorship, we quote a number of examples from recent developments covered by CHEMICAL AGE staff reporters. First there is the northern plant of a big company where the press were given fairly full technical details. One of the details not made available on the grounds that it would give-away vital 'know-how' was the name of the solvent being used, although it had already been described in one of the company's patents.

In the south a new plant—of which the company has every right to be proud—was allegedly thrown open to the press. Only no technical details were supplied, the labour force was sent home in case any vital information slipped out, and the only notes provided were of an historical nature. The press was asked not to record the fact that electric motors were flameproof as this would tell competitors that the solvent used was flammable; yet in the yard stood a road tanker bearing the words 'isopropyl alcohol'. The same firm did not want the words 'six large' to be used to describe a series of reaction vessels in case this should give a clue to their actual capacity.

Then there was the chemical engineering firm that recently exhibited a model of a new plant constructed for a client. Visitors were gladly told its purpose and for whom it was built—this information was not available, however, to the press who were asked not to photograph it even though it was on public exhibition. Co-operation with the press would have gained valuable publicity all over the world for the constructors and the chemical producers concerned.

Then what about the company that says 'No comment' when asked about certain pilot-plant polyolefin facilities. This despite the fact that photographs of the plant have been shown at various meetings where certain details have also been given. A case surely of mixed values when details can be given in public at a meeting, but are too secret for public airing in the technical press.

Frustrating? Then what about the company whose works manager recently issued a statement to the local press after an explosion. This was also published in at least one daily newspaper. In answer to a CHEMICAL AGE request for information, we were told to ignore the previous statement which was not incorrect and to confine our remarks to the fact that an explosion had taken place.

Patents provide rich ground for companies that seek to stonewall the press, despite the fact that a patent is available to any member of the public. To save time—a valuable commodity on a weekly journal—we occasionally ask companies about new patent specifications. Too often the answer is a request to publish nothing because of the 'danger' of drawing attention of the industry to it. Yet it is surely well known that most companies make their own patent researches to see what other people in the same field are doing.

Perhaps the biggest publicity gaff of recent years has been the Gas Council's handling of the liquid gas shipment which reached the U.K. two weeks ago in the *Methane Pioneer*. Not since the *Flying Dutchman* and the *Mary Celeste* has so much mystery surrounded the movements of a ship. Ordering, construction and actual sailing of the vessel have been cloaked in great secrecy; so much so that one can be excused for doubting its existence.

Reason for this reticence can only be guessed at since much of the information withheld by the Gas Council has been made freely available to U.S. Journals by Constock International Methane, the council's partners in the venture, who have had no such inhibitions. Last week CHEMICAL AGE was able to publish an exclusive report that the vaporised gas was being allowed to escape to atmosphere through vents on the deck of the ship. The Gas Council apparently felt that release of this vital information might prejudice the experiments—hence the speculation by many journals as to whether the vaporised methane would be re-liquefied and returned to tanks in the hold or whether it would be used to power the ship's engines.

CHEMICAL AGE has no wish to publish information that is genuinely confidential or which might endanger a company's competitive standing. Every company has certain process data which it must keep secret; in most cases that amounts to not more than 5 to 10% of the details concerned. With the other 90 to 95% the technical press could build up a worthwhile news story that would interest readers, who include customers and potential customers.

The present Mrs. Grundy approach to publicity does less than justice to the chemists and engineers who work in the British chemical industry. Every year more than £150 million is spent on capital investment in chemicals, a vast sum representing hundreds of individual triumphs of British scientific skill and administrative ability—achievements which should be shouted from the rooftops and not whispered down the proverbial well. It is the function of the technical press to record these developments—one which it does with pleasure and pride whenever it is possible to tell the story of British achievement.

This editorial is not the bellicose plea of a journal frustrated in its task of gathering and disseminating news; it is far more concerned with seeing that the progress of this great British industry does not go unheralded at a time when the chemical industries of other countries are less reticent. If it stimulates thought and discussion in boardrooms it will have done its task.

Doubtless it would help too if the Association of British Chemical Manufacturers were to appoint a public relations officer—with a press background—who should visit member-firms to explain how publicity can bring prestige and goodwill without disclosing process or plant 'know-how'. A good idea of how this can be done was shown by Chemstrand this week when they opened their new Acrilan plant at Coleraine, Northern Ireland, to the technical and general press. Much information was released and questions were freely answered on many technical aspects. Certain details, notably the character of the catalysts, inhibitor and certain chemicals used with acrylonitrile as the raw materials, were understandably not disclosed. There are other companies which follow a similar policy, but they are far too few in number.

ACRYLONITRILE PROCESSES

WITH Chemstrand's new Acrilan plant at Coleraine, Northern Ireland, now in operation (see p. 397) the focus is very much on acrylonitrile. Chemstrand are obtaining acrylonitrile for processing by sea from the Monsanto Chemical Co. in the U.S. This week Imperial Chemical Industries have chosen to announce that their acrylonitrile plant now under construction at Cassel Works, Billingham, is expected to go into production towards the end of this year (see p. 398). Raw materials which I.C.I. will use will be acetylene and hydrogen cyanide. Some of the acrylonitrile will be used by I.C.I., and some will be sold.

Latest news from the U.S. indicates that despite present overcapacity in acrylonitrile plant Standard Oil are to put their new acrylonitrile process based on propylene and ammonia into commercial production (see p. 407). There are also two new vapour-phase, solid-catalyst processes now available for licensing (*Chem. Engng.*, 1959, **66**, No. 4).

One of these two processes is that of Escambia Chemical Corporation, New York. Tested on a pilot plant scale, a larger unit is now under construction, by a "foreign chemical producer", who is reported as intending to check its commercial possibilities. It is not known whether Escambia will become producers or not, but they are not reticent about the process.

Escambia claim that their process operates on crude gas from a Saschsse process (partial oxidation) burner, containing only 4 to 12% acetylene. With this low acetylene figure it would hardly be practical to recycle unreacted acetylene, so the inference is that the process has a high conversion efficiency. A catalyst (unidentified) is used. It is not known also whether the Escambia process uses a fixed, moving or fluidised bed.

It is recalled that Escambia have developed a process for oxidising propylene with nitrogen tetroxide to produce lactic acid (*Chemical Week*, 23 August 1958). This could be ammoniated and dehydrated to give acrylonitrile.

The other new process has been developed by three Japanese professors at the University of Osaka, Japan, together with the engineering assistance of Professor Donald F. Othmer of the Polytechnic Institute of Brooklyn. It involves reaction of acetylene with hydrogen cyanide over a fluidised-bed catalyst. The catalyst is again unidentified but is stated to be a low-cost, long-lived and highly selective one.

This Japanese process has already been tested through two point-plant stages in Japan. Whether it is in commercial use there is not known. Conversion efficiency is reported to be over 92%, with a minimum of objectionable impurities in the product stream.

Another process is that of Knapsack-Griesheim A.G., Knapsack, near Cologne, W. Germany (CHEMICAL AGE, 1958, **80** (9 August), 226) which has been tested on a 30-ton a month pilot plant scale. It utilises acetaldehyde and hydrocyanic acid as raw materials from which lactic acid nitrile is produced. This is then split into acrylonitrile and water in the presence of phosphoric acid by direct action of hot combustion gases at about 600°C.

CHEMSTRAND ACRILAN PLANT ON STREAM

Built by British Contractors, Uses British Equipment

NOW in production at Coleraine, Northern Ireland, is the £3.5 million new plant for the production of Acrilan, the first acrylic fibre to be produced in commercial quantities in the U.K. The plant designed and constructed in a little over two years at a cost of more than £3.5 million will produce 110 million lb. of fibre a year for the British textile industry.

Acrilan, made largely from acrylonitrile, is suitable for spinning by any of the traditional processes and blends with traditional fibres to produce fabrics with special properties The material has been made for the past five years in the U.S. at Decatur, Ala., by the Chemstrand Corporation, and imported into the U.K. by Chemstrand Ltd., the U.K. subsidiary, for the past two years. It was first used by Yorkshire and West of England worsted and woollen manufacturers for quality suitings.

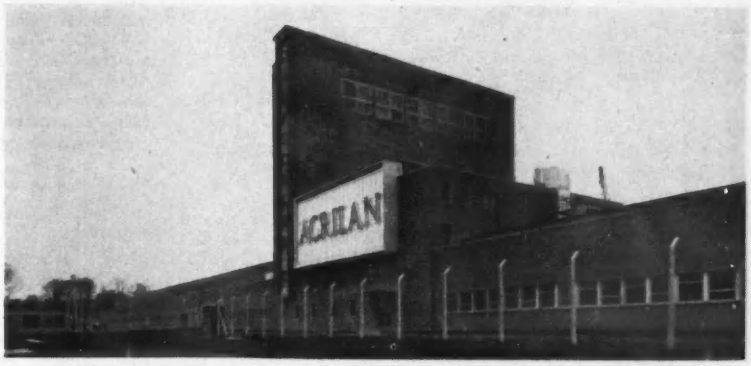
The plant represents a major achievement for British chemical engineers. Main contractors were Constructors John Brown Ltd. and most of the subcontracting companies were British. Baker Perkins Ltd., for instance, manufactured much of the equipment both in the chemical and fibre-making sections of the plant. In fact, the only U.S. equipment installed are specialised fibre-baling presses and certain physical testing instruments not available in this country.

Continuous Operations on Shift Basis

The plant, sited in beautiful surroundings on the banks of the Bann, has a high degree of automation and will run on a shift basis continually throughout the year. It incorporates both the chemical installations required for the production of the compounds from which the fibre is produced and the extensive mechanical equipment for spinning and processing the fibre.

Erection of the plant started in December 1956 when the official ground breaking was performed by Lord Wakehurst, Governor of Northern Ireland. The general contractors were Constructors John Brown Ltd.

Design and construction of the plant has been under the supervision of Mr. Chester H. Goodwin, Chemstrand Ltd.'s project manager, who has been based at Coleraine throughout the construction phase. An American, he has been with the U.S. company since 1950. As various areas of the plant have been commissioned, responsibility for them has been handed over to the general works manager, Mr. T. H. Makepeace, an Englishman, who took an honours degree in physics at Magdalen College, Oxford. Before joining the company he spent three years in Lima, Peru, as manager of the central finishing plant of the textile organisation of W. R. Grace and Company.



Central tower of the new Acrilan plant in which polymer and solvent are mixed rises to more than 100 ft. above ground level and dominates the site

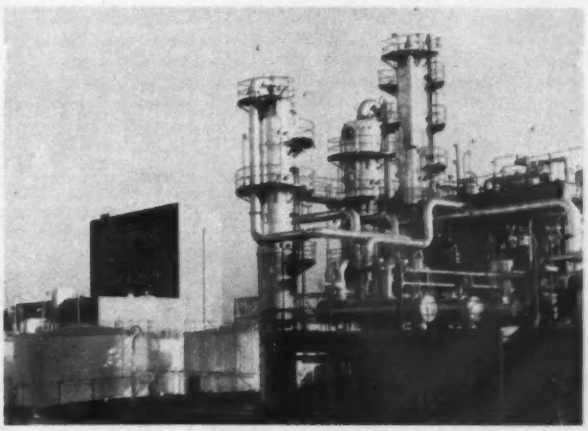
When in full production, the Chemstrand plant will be staffed by 400 employees who will work in ideal conditions. The safety of workers is protected to the maximum degree and safety precautions are augmented by appropriate industrial medical facilities. Life assurance and pension schemes are operated by the company. Both during the construction phase and when the fibre is in full production the plant will assist materially in easing Northern Ireland's unemployment problem.

Acrylonitrile used at Coleraine comes in tankers from the Monsanto Chemical Co., U.S., who also supply Chemstrand's Acrilan plant in Decatur. The process uses 1 lb. of acrylonitrile for each pound of fibre produced. It is understood that supplies may come later this year from a British plant. With other chemicals and catalysts, not specified by Chemstrand, the monomer is fed to the polymer building for polymerisation. This takes place at atmospheric pressure at a temperature of 130°F and continues for about 70 to 80 minutes under closely controlled conditions in the reaction vessel.

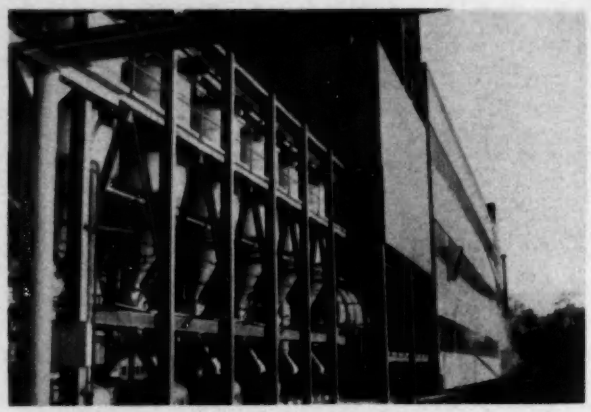
An inhibitor is fed in when the polymerised material is allowed to overflow with unreacted monomer to a reactor hold-tank. After passing through a rotary drum filter, water and unreacted material are removed from the slurry and the polymer cake is washed and passed to a reslurry tank before being pumped to a secondary filter. It then goes to pelletisers which form it into 'noodle' shapes for easier drying. After drying hammer mills crush the noodles into powder form.

Iron sulphate is sometimes added to give the correct polymer chain required. Moisture content of the polymer is a vital factor and variations cannot be corrected by drying; this problem is overcome by blending overmoist polymer with material that is not sufficiently moist.

Next stage in the Acrilan process is the mixing of the polymer with solvent to form the dope or spinning solution. The solvent is produced as the result of a reaction between acetic acid and



The solvent plant at Coleraine where chemicals are mixed to form a solvent in which the polymer is dissolved to form a spinning solution



The Acrilan polymer building where the main raw material acrylonitrile is mixed with other chemicals and catalysts to form a powdered polymer for blending with solvent to form a spinning solution

dimethyl amine—the resultant compound is not specified. The polymer meets the slovent feed in a mixer-extruder and passes as a slurry to two buffer tanks. A delustrant, titanium dioxide, is fed in as a suspension at the same time as the solvent to take the sheen off the finished product.

Heating in a reactor at 70 to 85°C to get the material into solution is followed by cooling to 50°C. The material then drops into a deaerating tank and passes through Johnson continuous filter presses to the spin tank.

The spinning solution or dope is extruded though spinerettes in baths that are continuously enriched with solvent. About 99% of solvent is recovered. A washing process here gives positive stretch to the material and a finishing is applied for easier handling.

The continuous filaments are then crimped and dried and after a time-lag are recrimped to make sure that they will process correctly. A specially designed Beira centrifugal cutter converts the tow into a staple fibre. This machine, like many others in the plant, was made by Baker Perkins.

Cooling water is drawn into the plant at a rate of 350,000 gall. per hour from a stream 1½ miles away. Effluent is neutralised, according to pH with either caustic soda or sulphuric acid, and is passed through a 10 in. mild steel main to the sea seven miles away.

The utilities section includes two Holmes-Kemp nitrogen generators to supply inert gas for blanketting all storage bins containing powders. Capacity of each generator, only one of which is in use at any time, is 200 cu. ft. per hour.

Only deionised water is supplied to the polymer bins. After flocculation with aluminium sulphate and Dow's Separran to remove algae, etc., water passes through cation cells, followed by anion cells and finally mixed bed cells containing ion-exchange resins. Conductivity of the deionised water is less than 1 micromole.

In the solvent recovery section, water is separated by distillation and the solvent has only to be slightly purified. The adjacent solvent manufacturing section produces only small quantities because of the high rate of solvent recovery. As in the polymerisation section, catalysts used here are not specified.

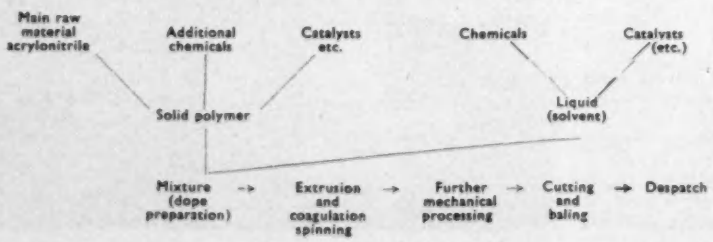
Nearby is a distillation column for the recovery of unreacted acrylonitrile.

Great stress is laid on quality control at all stages in the process, and there are well equipped chemical, physical and dyeing laboratories. Good housekeeping principles and stringent safety precautions are followed. Textile machinery has been installed so that Chemstrand can ensure that the finished product is readily handled in the various sections of the textile trade.

Chemstrand Ltd. are a wholly owned operating subsidiary of the U.S. parent company which is owned jointly by Monsanto Chemical Co., St. Louis, and the American Viscose Corporation, Philadelphia. The U.K. company was registered in November 1955 and in 1956 headquarters offices were established at 8 Waterloo Place, London S.W.1. The London offices now house the financial, secretarial, administration, sales and publicity departments and are the main operating centre of the company. A technical service department operates from 222 Royal Exchange, Manchester 2.

Directors of Chemstrand Ltd. are: E. A. O'Neal, Jnr., chairman and president of Chemstrand Corporation; Arvon L. Davies, managing director, R. J. Breyfogle (U.S.), R. C. G. Clarke and Sir Miles Thomas, chairman of Monsanto Chemicals Ltd.

Simplified diagram of Acrilan process



Much of Warren Spring Lab's Work will be on Chemical Engineering

THE D.S.I.R. Warren Spring Laboratory will be opened by Lord Hailsham, Lord President of the Council on Monday, 29 June. The new laboratory will assist Government Departments and industry by resources not available in any other establishment of D.S.I.R.

It will carry out research and development in a wide field and will not be limited to particular aspects of technology. Its initial programme will include work on mineral processing, the synthesis of oils and chemicals from carbon monoxide and hydrogen and research aimed at the suppression of atmospheric pollution.

Much of this work will be of a chemical engineering character and will require basic chemical engineering research to be undertaken in parallel with it.

The station will be free to take up any research requiring staff and facilities of the type that are being provided. For the time being research on atmospheric pollution will continue at Greenwich, where the address is the Atmospheric Pollution Division, Warren Spring Laboratory, Riverway, East Greenwich, London, S.E.10.

Acrylonitrile from I.C.I. Plant within Year

I.C.I.'S PLANT for the manufacture of acrylonitrile which is being constructed at Cassel Works, Billingham, on Teesside (Chemical Age, 10 January, p. 94), is expected to go into production towards the end of this year. It will be the first large-scale unit of its kind in the U.K.

Acrylonitrile from the new plant will be sold principally for the production of acrylic fibres. A smaller but expanding outlet is in the making of high impact-strength resins. Part of the output will be used within I.C.I. in the manufacture of the Butakon range of butadiene/acrylonitrile synthetic rubbers.

Raw materials for the new plant are acetylene and hydrogen cyanide, both of which are available on a large scale from sources within the I.C.I. general chemicals division.

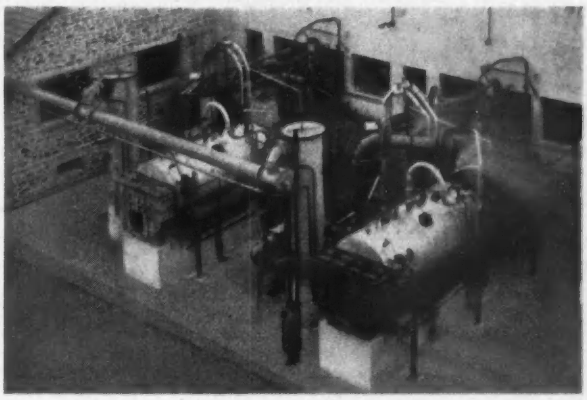
Humglas to Supply Singapore Oil Gas Plant

Humphreys and Glasgow Ltd. have received an order worth £95,000 from the City of Singapore for a fourth unit of Onia-Gegi oil gas plant and additional ancillary plant for their gasworks.

Last year the coal carbonising plant was replaced by three oil gas units with a daily output of 2 million cu. ft. Increased demand has made a fourth unit necessary.

M.S. TOWN GAS PROCESS OUTLINED

French Technique Licensed to Woodall-Duckham



A two-unit installation each of 1 m.c.fd. with waste heat boiler and control equipment

TOWN gas possessing completely interchangeable characteristics can be produced by the 'MS' process invented by Stein and Roubaix of Paris and developed jointly with Gaz de France, utilising refinery and L.P. gases and methane. As was indicated in CHEMICAL AGE, 14 February, page 283, Woodall-Duckham Construction Co. Ltd. have been licensed to exploit the 'MS' process in the British Commonwealth, Eire and Scandinavia for the production of town gas.

To obtain optimum results, close control is required in the cyclic reforming process. Desired temperature of the catalyst bed is within some ±20°C of the optimum temperature for the particular hydrocarbon feedstock employed. Proportions of gas, steam and air must be precisely determined and held throughout gas-making operations. To compensate for any variation in the flow of feedstock, air or steam, which could lead to faulty cracking, the 'MS' control system was devised by Stein and Roubaix. Control of the cycle is achieved pyrometrically, the length of the 'heat' and the 'make' phases of each cycle being determined, respectively, by the permissible upper and lower temperature limits of the catalyst.

Single Shell Generator

Essentially, the plant comprises a single shell generator carrying the catalyst bed (nickel-base catalyst), a water seal (wash box) and a direct washer scrubber. Each complete cycle is divided into heating, gas-making and steam purging phases.

Heating. Hydrocarbon feedstock and air are introduced tangentially into the upper part of the generator where ignition and burning take place, the products of combustion passing downwards and supplying heat to the catalyst bed.

Steam Purging. Feedstock and air are shut off and steam is introduced at the top of the generator, driving out the inert products.

Gas-making. Predetermined proportions of feedstock, steam and air are introduced into the top of the generator where thermal cracking occurs and the gases pass downwards through the catalyst bed, where the final reaction takes place. The amount of air introduced determines the specific gravity of the final gas.

Steam Purging. At the end of the gas-making cycle the system is purged of combustible gas in readiness for the re-introduction of the heating phase. At the same time any carbon formed in the gas-making phase is gasified by the steam.

The Plant. The cylindrical generator is refractory-lined; the nickel-base catalyst is positioned midway up the generator carried on brick arches and supporting chequerwork. Chequer brickwork is placed on top of the catalyst bed, acting as a thermal flywheel, protecting the catalyst from deterioration due to thermal shock and superheating the incoming feedstock/steam/air mixture. The hot cracked gas leaves the generator at the bottom and passes through a water seal to a scrubber and to the storage holder.

Automatic Operator. An automatic operator initiates movements of the various valves to effect the different phases of cyclic operation. Valves are pneumatically actuated and controlled by solenoid-operated air valves. The driving motor is set in motion by a regulating pyrometer which obtains impulses from a thermocouple inserted into the catalyst bed. Adjustable limits on the pyrometer fix the minimum and maximum temperatures of the catalyst bed.

'Make' Phase

In the 'make' phase, the catalyst bed temperature progressively drops until the pyrometer pointer reaches the position where the automatic operator is started. This sets in motion the respective solenoid controlled valves to stop gas-making, introduces the steam purge and turns on the heating burner and air supply. When the valve operations are completed the driving motor is stopped by a control cam. The catalyst temperature then begins to increase, the pyrometer pointer rises and on reaching the upper pre-set limit, the 'heat' phase is stopped and the steam purge is introduced and the plant is again set to gas-making.

This combination of time and temperature control results in close control of operating conditions, the working cycle being regulated to compensate for any accidental variation in flow rates or in the characteristics of the hydrocarbon feedstock.

Using the 'MS' process, the plant can be in operation from cold within a few hours, gas-making commencing when the catalyst bed upper temperature is reached. In practice, the plant is operated at its rated capacity, variation in demand being met by 'standing' the plant with all valves closed. During a 'standing' period the plant can remain at working temperature by entering into a 'heat' phase. Thus gas-making can be immediately resumed at any time. The plant does not, therefore, require a full-time operator, occasional routine inspection being sufficient. Audible, visual warning systems are built into the plant.

Efficiency of the Process. Reporting on the 'MS' process, Reboul (Gaz de France) and Gross (Stein and Roubaix) at the Congres de l'Association technique du Gaz, July 1956, showed that the efficiency of reforming a gaseous feedstock to a calorific value of between 220/290 B.Th.U. was about 78%. When this gas is cold enriched to normal interchangeable town gas calorific value of 475/500 B.Th.U., overall efficiency increases to between 85% and 87%. Direct production of normal interchangeable town gas of 475/500 B.Th.U. has been achieved at an overall efficiency of 78%, efficiency rising slightly with any further increase in the calorific value of the gas. 'Heat' and 'make' gases are passed through a waste heat boiler, making the plant self-contained for process steam. Two generators can be synchronised to operate alternately so as to provide a steady output of gas. If required, a number of generators can be arranged in pairs.

S.A.C. Microchemistry Group Elect Officers

At the annual general meeting of the microchemistry group of the Society for Analytical Chemistry on 20 February, the following were elected officers: chairman: Mr. F. Holmes, vice-chairman: Mr. C. Whalley, hon. sec.: Mr. D. W. Wilson, Sir John Cass College, Jewry Street, Aldgate, London E.C.3, hon. treas.: Mr. G. Ingram.

At an ordinary meeting which followed, Mr. D. F. Phillips, F.R.I.C., presented the retiring chairman's address.

★ THE NEW Acrilan plant of Chemstrand which about two weeks ago produced its first batch of fibre, represents a notable triumph for British chemical engineering. I am delighted—as most of my readers will be—to see a U.S.-controlled company entrust a U.K. firm with the responsibility of being main contractors for the project. British chemical producers, who are so prone to ignore the claims of their own plant industry, could well take note of this fact.

Constructors John Brown, the contractors concerned, have provided Chemstrand with the finest acrylic plant in the world. It is particularly commendable that all the chemical plant and equipment is British, as is most of the laboratory equipment used. The only U.S. equipment are the baling presses and a few physical testing instruments.

Much of the special machinery was made by Baker Perkins Ltd. Main plant material is stainless steel. Ducting is largely in aluminium, with a small amount in stainless steel

★ NEWEST division of I.C.I., Heavy Organic Chemicals, is spending £1 million a year on research and development said Mr. R. A. Banks, the company's personnel director, at a recent dinner of foremen from the oil and olefin works. He added that U.K. expenditure on research in 1955 was £300 million, including Government spending and research carried out by private companies on behalf of the Government.

The figure for non-Government industrial research was about £120 million. At that time, I.C.I. were spending £10 million a year on research, or one-twelfth of the total expenditure on industrial research. Mr. Banks declared "One can never say if we are spending the right amount of money on research, but I suggest that in the field of heavy organic chemicals it is of as much importance as in any other branch of I.C.I."

★ A YEAR after Perkin discovered mauveine just over a century ago, a young consulting chemist, Greville Williams, produced the first quinoline dyestuff, cyanine or quinoline blue. Williams founded one of Britain's leading dyestuff manufacturers, Williams (Hounslow) Ltd., whose new food colours plant was described in CHEMICAL AGE last week, p. 353.

The company has been connected with the foodstuffs industry since coal tar colours were first used in food. It commissioned what must have been one of the first independent investigations to be made in the use of colours in food and when I visited the works I saw the original report by Professor Rideal which was published in *The Lancet* in 1911.

When the company's own staff designed the new plant they could thus bring years of accumulated experience to bear. In the design they have gone to great lengths to avoid contamination and the wide use of automatic aids makes it possible for the plant to be totally enclosed.

★ I LEARN from a U.S. correspondent that the shares of the General Aniline and Film Corporation, a concern taken over by the American Government under the war-time confiscation of enemy property scheme, will be sold in April at a price of between $200 and $210 per share. The sale has been made possible by the refusal of the I.G. Farbenindustrie A.G. in liquidation to take any further part in the law suits connected with the proposed sale (Distillates, 7 February).

The Swiss company Interhandel is said to have declared itself prepared to accept 35% of the sale price, thus killing recent rumours that it would take between 75 and 80%. The remaining 65% of the sale price would be handed over to the Enemy Property Administration to be held until the future of German confiscated property in the U.S. had been decided.

At least 30 different U.S. industrial organisations are believed to be interested in buying the shares. These include the New York finance house of Bache and Co., who last year formed a syndicate for the purchase of the company.

★ FIRST commercial voyage of the flexible barge being developed under the sponsorship of the National Research Development Corporation was made last week. The cargo was 10,000 gall. of kerosene delivered from Esso's Fawley refinery to Newport, I.o.W.

The 10-mile voyage, described as a complete success took two hours. After the cargo had been pumped into storage tanks in 65 minutes, the envelope of nylon and synthetic rubber was filled with CO_2 and towed back to Fawley. In general use, the barge may be wound on to a reel and stowed.

Two of these barges, built by Dracone Developments Ltd., have been ordered at a cost of more than £3,000 each for use in West Africa. The company is now building a 'vessel' 200 ft. long, twice the length of that used by Esso, with a cargo capacity of 350 tons.

★ MARKING a successful attempt to arrest the oxidation which is caused by the interaction between minerals and vitamins when the two are stored together is the introduction by Boots Pure Drug Co. of the first combined vitamin and mineral food supplement for poultry with a guarantee of vitamin stability for 12 months. The new supplement Vita-Mindif eliminates the need for separate mixing of vitamins A and D_3. The company is hoping that in future a successful combination of vitamins will be made with other products.

The problem of combining vitamins and minerals in a single food supplement that can be stored over a period of time has occupied scientists at Boots for more than three years. Early tests had shown that, even with protected vitamins interaction set up oxidation which could cause loss of potency in the vitamins in anything from a few hours to a few weeks. Now Boots claim that they have succeeded in eliminating the effects of oxidation for a period of at least 12 months without altering the carefully balanced mineral salts formula.

★ RECENT reports associating Imperial Chemical Industries Ltd. with a so-called 'cure' for cancer have led the company to make a statement. The Pharmaceuticals Division is continuing its 20-year old research on cancer and although possible leads have emerged from time to time, they had not as yet provided any positive results.

I.C.I. are unable to express any opinion as to whether or when this work might have a successful outcome and reports that this is imminent are stated to be "without foundation and, in view of the false hopes that they can raise, are to be regretted".

While the company attaches great importance to its pharmaceutical interests, these are, of course, a relatively small part of I.C.I. interests as a whole, so that in the event of a successful outcome to its research work on cancer, the company's commercial and financial position would not be significantly affected.

★ ALTHOUGH pyrites and sulphur shipments have not been making much of a show, I was interested to see from a recent report on ship freights (*Monthly Freight Review*, No. 2) that Lacq sulphur was chartered to Germany at a rate fully $2.50 below the equivalent for the U.S. or Mexican material. Transatlantic sulphur producers do not seem unduly alarmed, nor do they envisage being driven out of the market on this side of the Atlantic.

Apparently they believe that European acid makers will not want to put 'all their eggs in one basket' so far as raw material supplies are concerned.

Also of interest is the fact that a contract for the shipment of pyrites is reported from Camamu in Brazil, a source not previously in the news. Delivery of 22,000 tons is to be made to Venezuela at $5.75 per ton, free-in-and-out.

Alembic

NEW DUTCH RESEARCH ON ORGANOTINS

Current Projects Outlined in Report of International Tin Council

SYSTEMATIC research on organotin compounds, and industrial applications of the products has continued on behalf of the International Tin Research Council, the Council's annual report for 1958 records. This research is under the leadership of Professor G. J. M. van der Kerk at the Organisch Chemisch Instituut, T.N.O., Utrecht, Holland. Further investigations have been made into the addition reactions involving organotin hydrides. These reactions open a new way for preparation of a great number of functionally substituted organotin compounds which have hitherto proved difficult to prepare. The reactions have also shown clear possibilities of developing polymeric substances, some of which it is considered, may have useful properties. Some work has already been done on the properties of the mono-substituted organotin compounds, and some further work will be done.

Work at Leicester

Research has continued at the University of Leicester, under the direction of Dr. C. Eaborn on some aspects of the chemical reactivity of organic compounds and Mr. A. N. Worden of the Nutritional Research Unit, Huntington, has conducted an investigation of the anthelmintic value of a number of organotin preparations. In the Council's laboratories, work has continued on the separation and determination of tri- and di-alkytin compounds, mainly by physical methods. Tests have been carried out on samples of p.v.c. stabilised with organotin compounds to ascertain the extent to which the compounds are extracted from p.v.c. under a variety of conditions laid down by the British Plastics Federation. It became evident during the tests that it might be necessary to differentiate between different dialkyltin compounds present in p.v.c. particularly in view of the great difference in toxicity between dibutyl tin and dioctyltin compounds. Wet-ashing and determination of inorganic tin does not give this information and extraction and measurement of the organotin compounds are required. The I.T.R.C. have now devised an extraction procedure which is reported to have given good results on samples of clear p.v.c. sheet.

Hot-tinning. Of the experimental hot-tinning studies it is reported that direct immersion in molten tin or solder followed by centrifuging, separating and quenching gives excellent results in many cases, although with certain limitations as when tinning brass. Experience gained in the various investigations has contributed to the design of a combined centrifuge and separator. This equipment is in course of construction and will be available for trial shortly. Recent experiences on preparation prior to hot-tinning, use of undercoats, details of melting techniques, etc., are in course of publication. Work on cleaning and pickling of steel strip prior to hot-dip tinning has indicated that anodic pickling at ultra-high current densities makes possible effective pre-treatment of steel. The special fluxing treatment designed for copper strip tinning may, with certain modifications, be suitable for steel. The process for coatings formed by electro-plating followed by melting ('melted coatings') consists of electro-plating tin or tin-lead alloy to the desired thickness followed by momentary melting of the coating in hot oil or other suitable medium.

Tinplate Studies. Collaborative research with other laboratories on methods of estimation of the small amounts of cottonseed oil normally present on the surface of electrolytic tinplate has indicated that a method devised by the Metal Box Co. gives consistent results. This method has assisted the I.T.R.C.'s study of the effects of new and aged oil films, with and without prior chemical treatment, on lacquer film characteristics. Certain lacquering difficulties, it has been discovered, can arise not only from excess oil but also from the ageing of the oil film, irrespective of its quantity. Ageing may produce a layer which is resistant to removal by solvents which readily dissolve the fresh oil. The oxide filming procedure, it is suggested, may have considerable effect on the adhesion of lacquer coatings.

Poly-azo Dyestuffs

Packing a solution of poly-azo dyestuff in cans has given rise to de-tinned and cracked cans. In some conditions, this dye and certain other poly-azo dyes, can remove tin from tinplate and can cause cracking of stressed tinplate steel. Such reactions are aided by the absence of water, by the presence of traces of inorganic chlorides and by the use of particular solvents. Although the solvents themselves have no action on the tinplate, the combination of some dyestuffs with lower solvents has caused difficulty. It is considered likely that the formation of complexes of tin and iron with the dyestuffs may have a strong influence, and this hypothesis may be of wider interest in fundamental corrosion studies.

Electrochemistry and corrosion. An electrochemical method has been devised to provide a numerical index of the porosity of metal coatings, including those of tin and tin alloys. The metal carrying the coating is made the anode in a test cell, the electrolyte and current density being chosen so as to ensure that current is carried only by the exposed basis metal and that polarisation of the basis metal is insensitive to small changes of current. The variation of the measured potential of the test piece with changes of applied current is then governed by the electrical resistivity of the electrolyte contained in the pores. A resistance valve for the pores can thus be measured. Values obtained are stated to reflect well the behaviour of porous coatings in corrosive environments.

Electrochemical measurements are also being used in the study of the effects of metallic diffusion in coatings of tin on brass and copper. Such diffusion has importance both in general corrosion behaviour of the coatings and in their retention of easy solderability. Thus the arrival of very small amounts of zinc at the surface of a tin coating on brass can easily be detected by measurement of corroding potential in dilute chloride solutions.

Pilot Plant Studies

Experience with pilot-plant scale work of the process developed for the electrodeposition of tin in bright form using an addition agent based on selected wood tars has allowed I.T.R.C. to issue working instructions and arrangements made for production of a 'revivifying agent' for the electrolyte. Efforts to separate the component in wood tar responsible for the brightening effect have been pursued. Some apparently homogenous active material has been recovered by displacement chromatography, but identification has not been possible. It is suggested that the active material is unstable when separated from the parent material.

Corrosion tests on bright tin deposits on steel have confirmed that thickness for thickness, the coatings deposited bright are somewhat less porous.

Tin-base alloys. The possibility that traces of aluminium in tin alloys such as babbit alloys might cause intergranular corrosion has been examined. This has not been discovered, however, in the particular antimonial alloys containing traces of aluminium and is considered to be due to the scavenging effect of antimony upon aluminium with which it forms an intermetallic compound. During the year the solid-solubility of antimony in tin has been re-determined, and, contrary to previous work, it has been shown that the solid-solubility decreases to less than 0.5% at 50°C.

Titanium-tin alloys. The very marked strengthening which tin confers on titanium has been confirmed. Sintering is stated to provide few difficulties, so that the powder-metallurgy method of preparation is attractive. An investigation is now being carried out into the possibility of preparing by powder metallurgical approach the ternary titanium-aluminium-tin alloys whose compositions approach those of the arc-melted alloys

WIDER APPLICATIONS OF M & B's Di-(p-TOLUOYL)-D-TARTARIC ACID

WIDER applications of di-(*p*-toluoyl)-D-tartaric acid, a reagent for the characterisation and purification of organic bases in general whether optically active or not, are described in the latest *M and B Laboratory Bulletin* (1959, **III**, (February) 57). The reagent was introduced in 1943 for the resolution of racemic lysergic acid hydrazide and later in the same year to separate the ergotoxine group of alkaloids by fractional crystallisation of the di-(*p*-toluoyl)-tartrate of the mixture. The salt-forming properties of the acid have been exploited in isolation of alkaloids of certain rauwolfia species.

Prepared originally in the M and B laboratories in connection with the study of rauwolfia alkaloids, the value of di-(*p*-toluoyl)-tartaric in other fields became apparent. The reagent is now used for the low-melting or slightly impure basic product which does not respond to crystallisation attempts and whose commoner salts, such as the hydrochloride separate as oils or hygroscopic solids. While the acid cannot be regarded as a universal crystallising agent for bases the successes are described as striking and tend to occur where all else has failed.

Di-(*p*-toluoyl)-D-tartaric acid is prepared according to a modification of the process first described by Stoll and Hofmann (*Helv. chim. Acta*, 1943, **26**, 922) by reacting an excess of *p*-toluoyl chloride with D-tartaric acid. The anhydride forms first, which, after recrystallisation, is hydrolysed to the acid by slightly aqueous acetone. The acid is readily soluble in cold ether, methanol, ethanol and acetone, and salts may be prepared by mixing the components in concentrated solutions of any of these solvents, or by double decomposition in aqueous media. A slight excess of the acid (on a 1:1 basis) is recommended since the vast majority of substances have in the M and B workers' experience given acid salts.

The di-(*p*-toluoyl)-tartrates, it is stated, can be recrystallised from a wide variety of solvents depending largely on the nature of the base. Solvents found to be particularly useful are methanol, aqueous methanol, ethyl acetate, light petroleum ether and, in insoluble cases, dimethylformamide. To regenerate the base, a soluble salt can be shaken in a water-immiscible solvent, e.g., chloroform-methanol) with aqueous alkali and the base recovered from the organic layer. Less soluble salts have been dissolved in warm dimethylformamide and treated with ammonia, followed by dilution with water and solvent extraction.

More Research Needed On Use Of Surfactants In Pesticides — Dr. Hartley

IN his paper on 'The role of surface active substances in the application of pesticides', given at a recent joint meeting of the Surface Activity and the Pesticides Groups, Society of Chemical Industry, Dr. G. S. Hartley, confined his remarks to the subject of surface activity at the surface of water, i.e. the boundary with air, another liquid or a solid. (See also CHEMICAL AGE, 2 February, p. 317.)

Since the use of the first surface active compounds—the natural soaps consisting of a long straight paraffin chain and a hydrophylic group, usually an alkaline earth metal, there had been a tendency to use cheaper short chains from the petroleum industry. These short chains were sometimes branched and had numerous synthetic bridges. However, they would not form as high concentrations as the natural straight chain paraffins, because the branches would not allow as much crystal packing when they aggregated in the bulk of the solution.

Apart from economics, there were other aims in improving on natural soaps. The insolubility of the calcium salts created difficulties in hard water and natural soaps were also inactive in acids which could create problems particularly in the dyestuffs industry. In agriculture where the available water varied in hardness and acidity from area to area, those two factors alone could create serious difficulties.

There was also a tendency to replace the alkaline earth hydrophylic group with a non-electrolytic group, such as an ester, often sulphate esters. The effect of both replacements was to cut down the variations with different types of water.

Dr. Hartley spoke of another aspect in the use of the shorter chained, branched paraffins which had not so far been stressed. Because of their geometry they tended to disperse more than straight chain compounds and could therefore be used as wetting agents, 'spreaders' and in aerosols. It was unfortunate that the apparent advantage in spreading was somewhat multiplied by the fact that their easier dispersal led to a corresponding difficulty in obtaining concentrated solutions.

Problems in agriculture which remained to be solved included leaf scorch and other damage by weedkillers and insecticides—damage that occurred only when a wetting agent was used. More research was needed into the surface structure of leaves, for hairs and waxy blooms on them could create an unwettable surface. Another problem was the fact that in general the more finely a compound was spread, the less resistant it would be to decomposition, so that a compromise between finer spreading and persistency must be made. The froth created by surface active compounds was a problem for the chemical engineer.

Rubber Association Stresses Need for Stable Prices

BECAUSE of the large expansion in synthetic rubber production capacity, there probably must be a very big drive to increase consumption over the next few years. This was stated by the chairman of the Rubber Trade Association, Mr. J. W. A. Calver, in his annual address. It could be presumed, he added, that manufacturers would tend to use more at the expense of natural rubber if technical problems associated with synthetic could be overcome. He emphasised that it was important to keep natural rubber prices stable because of the competition from synthetic rubber.

On the question of prices, Mr. Calver noted that one of the main features last year was that, despite the considerable excess capacity in the synthetic industry, demand for natural rubber continued to maintain the price at a substantially higher level than that of synthetic. It was quite possible, he suggested, that there might be an even greater price disparity before the end of the current year because of the shortage of supplies. Demand for natural rubber might be over 2 million tons (more than the foreseeable production at current price levels), if Communist purchases were at their 1958 level.

Import Duty Exemption Revoked

The Treasury have made the Import Duties (Temporary Exemptions) (No. 2) Order, 1959, which revokes the temporary exemption from import duty of phenylacetaldehyde dimethyl acetal from 28 February.

TIN RESEARCH

(Continued from previous page)

at present used by industry. Some exploratory work is under way on the effects of the addition of comparatively small amounts of tin to some of the newer metals (e.g. vanadium, zirconium). To I.T.R.C.'s vacuum sintering equipment has been added a small arc furnace which runs under argon pressure while a resistance furnace which will allow both melting and casting to take place *in vacuo* is due to be installed.

Tin-nickel and tin-cobalt alloys. Preliminary work on the heat-treatment of alloys of nickel and cobalt with tin has been started. Age-hardening effects have been shown at temperatures over 500° and 700°C. At prolonged treatment at 500°C cobalt-nickel alloys are reported to be likely to retain their increased hardness and strength.

Tin in ferrous metals. Tests on two compositions of nodular cast-iron in sections up to 3 in. have indicated that small additions of tin suppress ferrite without risk of formation of massive cementite. Investigations to date have shown that additions of tin can promote a substantially wholly pearlitic matrix without any risk to mechanical properties until the level of addition is well beyond the dosage required.

TRICHLOROETHYLENE OVERCOMES SOLVENT EXTRACTION PROBLEM IN TEXTILE INDUSTRY

"FOR over 30 years various methods of solvent extraction have been tried in the textile industry, so far with only a limited degree of success and that mainly with one particular fibre—wool," said Mr. W. A. S. White, General Chemicals Division, Imperial Chemical Industries Ltd., when he recently addressed the Manchester Section of the Textile Institute on 'The use of trichloroethylene in continuous scouring and bleaching of textiles'. Continuous solvent extraction of textiles, however, could now be accomplished in a safe and economical manner. The process also has a number of important applications.

In 1953 I.C.I. re-examined the use of trichloroethylene for solvent extraction of textiles. Trichloroethylene appeared to be able to extract both the natural fats in the raw fibres and the oils deliberately or accidentally added during the manufacture of textiles. Also trichloroethylene had a number of valuable properties such as non-inflammability, absence of chronic toxicity (although it had anaesthetic properties), good stability and high vapour density. Its low boiling point, low specific heat and low latent heat of vaporisation ensured moderate demands on fuel and cooling water.

Small Pilot Plant

Mr. White stated that I.C.I. engineers had designed and constructed a small pilot plant for the continuous scouring and bleaching of textiles, the first operation being the removal of fatty matter by means of trichloroethylene. Primarily work was conducted on cotton but was subsequently extended to various natural and synthetic textiles.

Wax removal from cotton. For removing wax from cotton, trichloroethylene was for all practical purposes as efficient as chloroform or methylene chloride the solvents normally used in estimating cotton wax. Immersion in boiling trichloroethylene for only about 15 to 30 seconds reduced the wax content of cotton cloths to approximately 0.15% from grey fat and wax contents of the order of 0.7% to 1.2%. The weight and construction of the cloth made very little difference to the rate or extent of extraction. The natural moisture of the cotton had little effect, but extraction was impaired if the cloth was saturated with water before the solvent treatment.

Published literature upon the exact function of wax in relationship to absorbency presented a number of anomalies, but there was no doubt that if the bulk of the wax was removed by solvent extraction it was then a relatively simple matter to make the cloth absorbent. Absorbency could be achieved by giving mild oxidation treatments that would effect little or no improvement in the absorbency of un-dewaxed cotton. Dewaxed cloth was also rendered absorbent by the hot water treatment that was used primarily to extract solvent held in the cloth.

The hot water method consisted of passing the cloth through water at above 73°C the steam distillation temperature of trichloroethylene. This 'hot water flash off' provided an effective means of recovering the solvent and, in addition, wetted the cloth, thoroughly removed part of the work size and also dispersed any residual surface wax with the result that the cloth became uniformly absorbent, an important point.

It is thought that by following the dewaxing with a peroxide bath to effect desizing and part bleaching a basic method for the rapid scouring of cotton cloth could be formed.

The peroxide bath consists of first saturating the cloth in cold peroxide solution of 1 to 2 volumes and containing 7-15 g./litre of sodium hydroxide and then steaming longer as the peroxide is unstable.

With regard to the commercial success of the continuous process of dewaxing and desizing in the dewaxing stage the loss of solvent is important. This loss is very small, however, being approximately 2% on the dry weight of material treated, equivalent to 1s 3d per 100 lb. of cloth. The amount of trichloroethylene retained in the cotton is negligible. As there is a small progressive loss of the organic stabilisers present in commercial trichloroethylene they have to be added periodically; this, however, presents no material increase in running costs.

The desizing stage has given no difficulties and bleaching results were generally satisfactory. The only important objections encountered were that in some materials the degree of whiteness and mote removal were inadequate for dyeing to very pale shades. The use of a short intermediate stage prior to desizing was one of several methods in an attempt to solve this problem and the most successful of these stages appeared to be the use of a cold acidified hypochlorite bath which activated the desize stage to produce whiter cloth. For stubborn cases where the motes persisted a continuous 30 minutes bath in peroxide or chlorite, after dewaxing and desizing, is advised.

For a fully continuous process to give completely desized and fully bleached cloth by the peroxide method it is estimated that the cost of chemicals would be about 4s per 100 lb. of cloth.

Rayon. Rayon and various mixture goods with the exception of viscose/acetate respond excellently to this treatment, Mr. White has reported.

Wool. As trichloroethylene will remove mineral oils from wools just as effectively as it does oleine, a cheaper spinning oil containing a high proportion of mineral oil can be used without a subsequent increase in the cost of scouring.

Removal of the finely divided dirt which is sometimes redeposited has, on the whole, been satisfactory. A very clean finished piece is obtained by following the process with soap milling.

The 'hot water flash off' of the process leads to a good deal of shrinkage and consolidation. Less loss of fibre, less water consumption, less effluent and no possibility of alkali damage are other advantages over normal methods; also in general dyed goods do not bleed.

A large still is required to cope with oil and the large accumulation of flock must be removed.

Jute, etc. Jute can also be successfully treated, but there appears to be no financial advantage in doing so unless a wet process is to follow.

The trichloroethylene process has proved commercially successful in removing the size used in the weaving and spinning of glass fibre.

Kestner Supply Second Evaporator For Travancore Rayon Works

FOLLOWING design and installation of special plant for the spinning bath acid recovery section of Travancore Rayons Ltd., consisting of a climbing film evaporator and a complete crystallising installation for the recovery of Glauber salts, Kestner Evaporator and Engineering Co. Ltd., 5 Grosvenor Gardens, London S.W.1, are now shipping a second evaporator to cope with a load that has steadily increased. This is of the latest multi-tubular type and all parts in contact with the liquor and vapour are of Keebush, the tubes and tube plates being in carbon. The new evaporator has a capacity of 2,900 lb. of water evaporated per hour.

The first evaporator was of special design in that the steam raising plant at the rayon factory necessitated the use of hot water instead of the more conventional steam for heating the calandrias of the evaporator. During the years that have elapsed the steam raising plant has been altered and so the new evaporator will be steam heated, instead of using hot water. The use of Keebush and carbon in the second evaporator gives the advantage that the resistance to corrosion does not depend on the use of linings, such as lead or rubber which might be prone to deterioration. Also pick-up of metals by the spinning bath liquor is eliminated since all contact parts are non-metallic.

The crystallising plant that was supplied in the first contract was of the Kestner brine-cooled rotary drum continuous type, and included heat exchangers and centrifuges for separating the Glauber salts from the mother liquor. At the present stage Travancore have not found it necessary to expand the Glauber salt recovery plant.

POSSIBILITIES OF PRODUCING SELENIUM FROM PYRITES

RECENT research investigations into the production of selenium from pyrites are recorded by Rudolf Kaiser, Dresden Institute for Applied Mineralogy, in the East German *Chemische Technik* (January 1959 issue, p. 34).

Kaiser refers to a report made by M. Skowerski, in the Polish journal *Przemysl. Chem.* (1956, *XII*, 423, [see also *Bergakademie*, 1956, **8**, 181], on the research work undertaken on the subject of selenium extraction at the Torún phosphate fertiliser plant under the leadership of J. Zawadski. The experimental process, which is described in detail in the Polish journal, was suggested as pointing the way to future developments. It did not solve the problem of selenium extraction from chamber acids' sludge (washing-tower acids' sludge), however.

Taking into consideration the small reserves of selenium ore and the considerable demand for metallic selenide for the electro-technical industry and for selenium salts for the organic chemicals, ceramic and glass industries, the attainable market price lies so low, remarks Kaiser, that the large-scale use of raw materials containing traces of selenium has not yet been resorted to. The element is contained in concentrated form in the sludge of lead chamber acid in as far as this is produced from roasting gases obtained by roasting pyrites containing small quantities of selenium. Since the discovery of this there have been many experiments made in the search for an extraction process. The washing-tower acids of pyrite roasting furnaces—used for the production of contact sulphuric acid or sulphuric-acidic roasting gas for other purposes—also often contain concentrated selenium in their sludge.

Low Concentrations

The amount of selenium to be found in acidic sludge is small, and only in very exceptional cases rises beyond a level of 0.1%. Despite this low selenium concentration content, however, the exploitation of such a source of selenium could prove promising when it is considered that in Western Europe alone 4½ million metric tons of pyrites waste is produced annually [H. Schlackmann, *Stahl und Eisen*, 1954, **74**, 1463].

Of the calcined pyrites it has been found that some 5% finish as fine dust in the washing-tower acid of the pyrites roasting plants and in the lead chamber sludge. The selenium is contained primarily in this dust. Reckoning a content of as little as 0.02% selenium in the dry substance of the sludge, this would mean an annual production of selenium of 45 metric tons—not far short of the demand.

It is obvious, however, that with such small contents of selenium involved labour in any extraction process must be cut to the minimum and the cheapest reagents and lowest power used for the process to be economic.

This necessity is borne in mind by a process developed in Bulgaria [Bulgarian Patents 7129/196 (1957) and DWP 14459 Kl. 12; (1956)]. By this method the sludge from the washing-tower acid is separated from the circulating acid by a continuous process. As previous experiments carried out by Kaiser have shown, the sludge separation is suitably carried out by a hydrocyclone of small diameter and made from lead or porcelain. The extra costs for the operation of a suitable centrifugal pump are to a large extent nullified by the saving of labour on the lengthy and very unpleasant job of cleaning the cooling apparatus and container of the acid circulation system. Further separation of acid from the thick sludge is by dilution with water which has to be done in any event in the gas cooling and treatment of the acid concentration. The sludge solution is allowed to pass through a suitable multiclon, a small pump. The excess from this process is returned to the washing-tower's circulation acid. The sludge can then be led on to a further multiclon after dilution to reduce the acid content yet further, or passed for final treatment in the selenium extraction process. Although the separation of sludge and acid is never quite complete, the degree of failure is negligible after continuous progress through the cyclone and through one or two stages of a multiclon. The success lies in the fact that the circulating acid is purified and the sludge brought to a state in which, in natural circumstances, it may be processed further.

The final process itself differs from former practice in that an alkaline oxidating agent is used to transform the as a rule elementary selenium to a soluble form. A relatively cheap agent for this is sodium bleaching lye. Oxidation takes place at room temperature. Percolating vessels and, for the separation of non-solubles, a filter drum may be used. The filtrate is neutralised at equally-spaced intervals and a sediment containing arsenic and with no selenium content is formed. The completely clear filtrate is then saturated with pure roasting gas in a well-insulated stoneware tower container, the liquid's circulation being controlled by pump. Pure red selenium is caught in inter-connected vessels, filtered off, dried and washed.

Using this method and with equipment of a requisite size, one person, Kaiser states, can take charge of the selenium extraction of an SO_3 installation with a 100 to 200 tonne capacity.

Experiments on a laboratory scale and in a small installation have proved a yield of from 60 to 84% of selenium from dry crude sludge with an 0.02 to 0.07% selenium content.

Two-furnace Technique Determines Halogens in Polymers and Oil

ANALYSTS at Esso Research Laboratories, Baton Rouge, Louisiana, have developed a two-furnace technique to determine chlorine and bromine content of polymers, gas oils and heavy residual oils. The apparatus consists of two furnaces, one operating at about 950°F, but its temperature adjusted according to the sample, and the other kept at 1800°F. A 96% silica glass tube allows the sample's combustion characteristics to be observed, and at the same time, enables the exact position of the sample boat to be checked.

The boat, with sample is placed in the first section of the combustion tube, and a push rod places it in the first furnace (950°F). When burning is complete (5 to 10 minutes) the boat is pushed to the 1800°F furnace where it remains about 10 minutes. Oxygen is added to the chamber at the rate of 3 l. per minute to ensure that combustion products are completely swept from the chamber.

With light oils or other volatile material 96% silica glass chips and a glass wool plug may be used in the second combustion chamber to provide a greater heating surface and minimise incomplete combustion.

Halogens are washed from the other combustion products in a scrubber with an aqueous solution containing 2% sodium hydroxide and 0.5% hydrazine sulphate. Other scrubbing solutions are sodium arsinite and sodium disulphite. Washings are collected in a beaker and halogen content is determined by titration.

Esso's analysts have found that the two-furnace method gives good repeatability and reproducibility in determining chlorine and bromine in polymers and other petroleum chemicals. The method has not been used for iodine.

Besides this furnace method overcoming the difficulty of burning samples larger than 0.2 gm., other advantages claimed are: volatile samples (e.g., gasoline fraction) can be analysed; analysis is rapid (with an automatic titrator), a single piece of equipment can process three samples an hour; the method is less subject to analytical error, even an inexperienced analyst being able to obtain satisfactory results; as combustion is carried out at relatively low temperatures, expensive equipment is not required.

Clean Air Society's Proceedings

Proceedings of the Llandudno conference, 1958, of the National Society for Clean Air, are published by the Society, Palace Chambers, Bridge Street, London S.W.1, at 12s. 6d.

Analytical Review

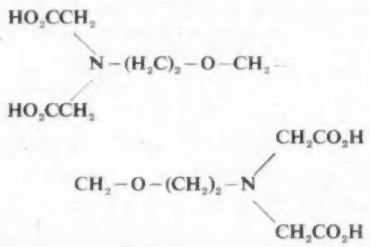
NEW COMPLEXONE EGTA SOLVES AN OLD PROBLEM

By
T. S. West, Ph.D.

This article reviews: (1) A new complexometric procedure which avoids the errors associated with the titration of calcium in the presence of large amounts of magnesium. (2) A sensitive procedure for the titrimetric determination of chloride or silver ion. (3) The coulometric titration of water with electrically regenerated Karl Fischer reagent. This last method solves the problem of determining small amounts of moisture in strong amines.

NOW familiar to everyone concerned with water analysis is the EDTA procedure for the determination of total and permanent hardness. What is not appreciated, however, is the unsatisfactory nature of the method generally applied for the determination of calcium in the presence of magnesium. This problem has recently been examined and it has been shown that no one indicator is satisfactory for the determination and indeed that some of the indicators which are commonly used are definitely suspect (**1**). In the range Mg/Ca $\leqslant$1/12 Acid Alizarin Black S.N. is recommended and in the range between 1/12 and 1/1, Calcon.

It is not possible to obtain quantitative recoveries of calcium in the presence of large amounts of magnesium hydroxide because of co-precipitation of the calcium and yet it is necessary to precipitate the magnesium to prevent it reacting with the complexone. Reilley and his co-workers (**2**) have applied the complexone EGTA



Ethylene glycol - bis(β - aminoethylether) N,N,N',N' tetra acid acid (E.G.T.A.)

to the problem and have now succeeded in devising a visual indicator method.

Stable Chelate

This complexone forms a stable chelate with calcium ($Log_{10}K = 11$) and a weak chelate with magnesium ($Log_{10}K = 5.2$) consequently we have the basis of a selective method for the titration of calcium in the presence of *soluble* magnesium provided an indicator is available which will change colour at the appropriate pCa. Unfortunately no suitable indicator is directly available, but these workers have found that zincon indicator sensitised with Zn-EGTA gives an answer to the problem (**3**). Zincon does not chelate with calcium or magnesium in ammoniacal solution, but when Zn-EGTA is added, the reaction

$$Ca^{2+} + HIn^{3-} + Zn\text{-}EGTA^{2-} \longrightarrow$$
Orange-yellow
$$Ca\text{-}EGTA^{2-} + ZnIn^{2-} + H^{+}$$
Blue

takes place and the orange red colour of the zincon reverts to the blue colour of the zinc-zincon complex. This colour persists until the remaining calcium and the zinc in the indicator is titrated quantitatively at the end-point.

The method has certain limitations. for example, a large amount of buffer cannot be added to the solution and it appears that it may be necessary to control the zinc content to a lesser degree; nevertheless, the procedure is a valuable one. Quantitative recoveries of 2.5 mg. of calcium were obtained in the presence of a twenty-fold molar amount of magnesium. Most of the operations seem to have been performed with 10^{-3} to 10^{-4} M calcium solutions, but one would infer from the tables of results that the procedure works equally well for somewhat more concentrated solutions.

For the record it may be noted that the combined magnesium *and* calcium procedure determines calcium as above and the magnesium in the same aliquot by the visual Eriochrome Black T procedure with EDTA as titrant after addition of potassium cyanide to mask the zinc against replacement reactions. A procedure is also described for the resolution of a mixture of zinc, calcium and magnesium; this involves the use of another "chelon", namely, tetraethylenepentamine for the zinc.

Blue Outlook for Analysts. The 1959 *Analyst* in its new blue cover will firmly convince all devotees of analytical chemistry that blue is a colour to be reckoned with. All the analytical journals emanating from U.K. or U.S. sources, and indeed at least one of the major continental ones, use the colour more or less characteristically.

This new issue of *The Analyst* contains several notable papers—one of the most interesting being that by Price and Coe (**4**) on the determination of chloride by a 'polarisation end-point procedure'. The method is essentially a straight-forward silver nitrate titration with the use of a pair of silver/silver chloride electrodes with an imposed potential of *ca* 30 mv as the indicating system. This development of the original Foulk and Bawden dead-stop end-point method (**5**) is capable of high sensitivity and sharp response as shown by the present application to the analysis of chlorine in titanium with 0.01 M reagents. Since both the silver and chloride ion yield reversible electrode reactions at the silver/silver chloride electrode, the titration curve is V-shaped and the position of minimum current or electrode response corresponds to equivalence. The procedure is simple and rapid and compares favourably with the rigidity of the turbidimetric method and its time requirement. The apparatus is simple, easily constructed and inexpensive.

The same authors have applied the method to the determination of chlorine in paper and certain types of water (**6**) and it should find many other applications elsewhere. In passing, it may be remarked that while the term amperometric used by the authors is etymologically correct, the method is not strictly amperometric in the usual sense of the word as accepted by chemical convention. A similar dead-stop end-point method which uses a polarised bi-platinum electrode system is described in the current issue of *Analytical Chemistry* (**7**). Here, however, the electrode reaction is reversible only towards the chloride ion, so that a less sensitive L-shaped curve is obtained.

Coulometric Titration of Water using Reagents. Meyer and Boyd (**8**) have described the coulometric titration of water with electrolytically generated Karl Fischer reagent. Normally the equivalence of the reagent is governed by its iodine content since it contains an excess of sulphur dioxide and pyridine. Meyer and Boyd find that iodine can be regenerated in spent (or pretitrated) Fischer reagent in an anhydrous methanol medium with 100% current efficiency. Thus the coulometric titration of water in many substances is made possible.

Attractive Features

The method as described has several attractive features. For example, there are difficulties, due to side reactions which consume iodine or produce water, associated with the titration of water in strong amines. ($K > 2 \times 10^{-5}$.) This can be circumvented in the coulometric method by the application of a small supplementary generating current to the working electrodes. In this procedure, the amine is partly neutralised with acetic acid before titration. It was found preferable, however, to work in a solvent medium of ethylene glycol and to use salicylic acid to neutralise the amine. In this medium, the conductivity is sufficiently low to prevent the application of the usual dead-stop end-point method so a variation was used in which a constant current is applied to the electrodes and the change in potential is observed as the titration proceeds. The supplementary currents required for this medium were only one-fifth of that required with methanol.

This coulometric method is claimed to be the only Fischer procedure applicable to the determination of water in strong amines at concentrations less than 1 mg.

ml. However, the upper limit of the method is such that samples which contain more than 10 mg. of water cannot conveniently be determined because of the time required. Indeed, the most suitable field of application is for routine analysis since the time necessary for servicing and setting up the apparatus for isolated single titrations would be excessive. Concentrations as low as 5γ H_2O/ml. can readily be determined in most solvents and the absolute standard deviation of the titration is approximately 2γ of water. A suitable automatic coulometric titrator for the above method has been devised by other workers (9).

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R.I.C. Members Hear Talk on Growth of Petrochemicals

IMPORTANCE of the petrochemical industry as a producer of both organic and inorganic chemicals could be judged by the fact that in 1955, 83% of the ethanol, 90% of the ammonia and 70% of the urea produced in the U.S. were derived from petroleum. This was a point made by Dr. S. F. Birch in a paper on petrochemicals presented at a meeting of the London section, Royal Institute of Chemistry, held recently at the South-West Essex Technical College, Walthamstow. Mr. F. C. Hymas was in the chair.

Utilisation of the saturated hydrocarbons obtained by cracking was illustrated by Dr. Birch, by reference to the synthesis of raw materials for the production of nylon and Perlon, and the preparation of Terylene from *p*-xylene.

In a detailed discussion of the cracking process, he described the differences between the raw materials and methods used in the U.S. and those in Europe. Naphtha was the raw material cracked in Europe, and was subjected to a milder cracking than in the U.S., yielding a high octane motor fuel, and low boiling hydrocarbons, the raw material for petrochemicals. These were separated by fractionation at low temperature. The variety of uses to which some of the olefins obtained (ethylene, propylene and isobutylene) could be put was described.

Conversion of ethylene to ethyl alcohol was accomplished by passing the gas and water over diatomaceous earth containing phosphoric acid. This yielded a condensation, a weak aqueous solution of ethanol. Similar processes were operated for propylene and isobutylene. Conversion of ethylene to ethylene glycol and ethylene oxide were also described, with the manufacture of glycerine from propylene, both by the conventional method and a novel route which did not involve chlorination of the propylene.

The manufacture of phenol and bisphenol A and the use of the latter in epoxy resin production were described. Dr. Birch concluded his lecture with a brief description of the preparation of alkyl aryl sulphonate detergents.

R.I.C. Talk on Molecular Sandwiches

ALTHOUGH organo-metallic compounds had been reported as early as 1850, it was only after the discovery in 1952 that iron reacted with *cyclo*pentadiene to form dicyclopentadienyliron, i.e., ferrocene, that much attention was given to this class of compounds of sandwich structure. This was stated by Professor G. Wilkinson in a recent lecture on 'Molecular sandwiches' at a joint meeting held between the London section, Royal Institute of Chemistry, and the College Scientific Society at the Slough College of Further Education. Mr. P. A. Raine presided.

The essential feature was the bonding of the central metal atom to all five carbon atoms of each ring. A d-orbital of the metal had to be available for the formation of such sandwiches and a large number of compounds had been prepared from the transition metals.

Professor Wilkinson then discussed the methods of preparation by the Grignard and the carbonyl methods, followed by reasons for their structure, outlining their properties and aromatic character and substitution reactions. He said that although much effort had been given to preparing numerous compounds over the last few years no industrial use had been found for these except as possible anti-knock additives to reduce the carbon deposition.

B.A. Seeks Details of Scientific Films

The 1959 meeting of the British Association for the Advancement of Science will be held in York from 2 to 9 September. The meeting will include a series of scientific films programmes compiled from recent film productions selected from all over the world, which either present scientific subjects to informed non-specialist audiences or demonstrate the use of film in scientific research. The B.A. would welcome suggestions for films (16 mm. only) which might be suitable for screening. Details should be sent to the Visual Aids Officer, British Association, 18 Adam Street, Adelphi, London W.C.2.

Geigy Introduce New Ultra-violet Barrier for Plastics

TINUVIN P, a new ultra-violet barrier for plastics which differs from the substituted benzophenone types in being based on a triazole grouping, is announced by the Geigy Company Ltd., Rhodes, Middleton, Manchester. It is said to have outstanding stability to heat and light, and in addition the triazole structure is believed to confer, in some polymers, a degree of antioxidant action which is seen in improved colour.

Investigations of possible uses is still in hand, but the following uses have already been established: polyester-glass fibre laminates (better clarity and colour retention); polystyrene (better clarity; protection against degrading action of u.v. light; can be added before polymerisation); polythene (colour of some grades is improved); p.v.c. (better light fastness; antioxidant effect improves natural colour provided polymer is not iron-contaminated; useful in p.v.c. film for farm use).

Work in progress suggests that Tinuvin P will also be useful in surface coatings where the substrate as well as the coating may need protection; in synthetic fibres and polyester and polyether foamed plastics to retard yellowing; and in plastics films used to protect shop window displays.

The amount of Tinuvin P required varies and is generally between 0.01% and 1.0%, according to the polymer and its use.

Power-Gas Co-operate in Fertiliser Project

A DECISION is expected soon on a proposed ammonium sulphate plant in Central Queensland which would cost £6 million and be capable of making 100,000 tons of fertiliser a year. A market survey has been made and technical information is being assembled.

It is estimated that sulphate of ammonia based on the use of pyrites from the Mt. Morgan mine, which also produces gold and copper, would cost £10 a ton less than imported fertiliser.

The estimated production of the new plant would make Queensland independent of imports of this type of fertiliser.

The Power and Gas Corporation of Stockton and the Chemical Construction Corporation of New York are co-operating in the investigations.

Waverley Essay Competition

The seventh Waverley gold medal essay competition is open to persons engaged in scientific work from 1 January to 31 July. A first prize of £100 will be awarded for the best essay of about 3,000 words describing a new scientific project or practical development giving an outline of the scientific background, the experimental results, and the potential application of the project or process in industry. Entries should reach the editor, *Research*, 4/5 Bell Yard, London W.C.2, by 31 July.

Overseas News

BY-PRODUCT ACETONITRILE FROM SOHIO'S NEW ACRYLONITRILE PROCESS

FROM Standard Oil (Ohio) Inc acrylonitrile plant now being planned, acetonitrile will be obtained as a by-product. Although the product will be obtained in commercial quantities total tonnage will be relatively small compared to acrylonitrile produced.

Acetonitrile faces overcapacity as does the acrylonitrile. Market investigations have revealed, however, that more acetonitrile could be sold, but at prices lower than the current 45 cents a pound.

The new process employs catalytic vapour phase reactions starting with a typical propane-propylene refinery stream and using ammonia as the only other raw material. The most probable route, it is suggested, is that propylene gives acrolein by catalytic air oxidation and then the acrolein is reacted directly with ammonia. The resultant product would be an acrolein-ammonia complex, or a ringed trimer. The former could be converted into acrylonitrile by splitting off hydrogen and a molecule of water. The trimer could be dehydrogenated into acrylonitrile. Another suggestion is that Sohio have developed a process whereby acrylonitrile is produced directly from acrolein and ammonia. Distillers Co. Ltd. have carried out such a reaction in the liquid phase, but reports state Sohio's process is entirely original and hence a vapour-phase route may be used.

Israel Phosphorus Project

Approval of the erection of a phosphorus plant in Dinmoa, Israel, by the Koor Company is reported by Barclays Bank D.C.O. The plant will cost about I£120 million, with an initial investment of I£11.5 million. Employment will be provided for some 200 workers. The plant will require some 250,000 tons of phosphates and in its first stages should be able to produce an estimated I£2 million worth of phosphorus.

The bank also reports that in 1958 the Dead Sea Works produced and sold more than 107,000 tons of potash compared with 78,000 tons in 1957 and 46,000 tons in 1956. There are good prospects of achieving 135,000 tons this year.

New Process Gives Prilled Fertiliser without Prilling Tower

Chemical and Industrial Corporation, U.S., claim that their new Spherodizer process produces prilled fertiliser without a prilling tower. In the process a reaction slurry is sprayed into a rotating drum instead of a tower. As particles form, they shower down through slurry spray and build up to product size. Hot gases are blown through the drum countercurrent to the flow of prilling solids and dry the product. The company stated that the process eliminates auxiliary concentrating equipment, and costs about half as much as a conventional tower set up. It has been used to date to prill most fertiliser materials, including urea, and can also serve as a granulator.

New French Company to Make Polystyrene

A new company which will produce raw materials for the synthetic rubber industry, has been set up in France under the name of Les Matériaux de Synthèse. The two mother concerns are the French firms Bozel-Malétria, of Rivière-Saint-Sauveur, and Syroup, of Saint-Etienne, Loire. The new company will be particularly concerned in the manufacture of polystyrene.

Australian I.C.I.'s Big Capital Outlay

Construction work on manufacturing projects for Imperial Chemical Industries of Australia and New Zealand in the past year cost £A3.7 million, the chairman, Mr. K. G. Begg, told the annual meeting in Melbourne.

There was a growing demand for the company's products, he said, but competition had become keener and large capital expenditure must continue in order to maintain the company's leading position.

A Swiss Subsidiary Formed by Dow

Formation of a wholly-owned subsidiary, Dow Chemie Aktiengesellschaft, in Bâsle, Switzerland, is announced by the Dow Chemical Co., Midland, Mich.

The company will finance Dow's expanding interests overseas, especially in the European Economic Community. The company was incorporated with an initial paid-in capital of 25 million Swiss francs.

New Emulsion Plant for Celanese of America

Celanese Corporation of America have brought into operation at their Belvedere, N.J., plant, an installation for the production of 10,000 short tons a year of polyvinylacetate emulsions.

Total Synthesis of Tetracycline By Lederle Laboratories

Lederle Laboratories Inc., U.S., have achieved a total synthesis of the antibiotic tetracycline after three years of research. The process which gives a derivative of dimethylchlortetracycline, involves 30 separate steps. Although not at present a commercially economic possibility compared with the current fermentation method used to produce this antibiotic, it is expected that the process will pave the way to synthesis of entirely new compounds which cannot be produced by fermentation.

Pfizer Expansion in S. Africa

The Pfizer Corporation of America have decided to erect a plant on a 5½-acre site recently bought for £35,000 by its S. African subsidiary in the Industrial area of Johannesburg. The group plans to make this one of the main world depots for its products.

German Firm Wins Indian Ammonia Plant Contract

A contract for the erection of an ammonia plant for the processing of coke-oven gases from the new Indian steelworks at Rourkela into synthetic fertilisers has been awarded by Hindustan Steel Private Ltd. to the West German company Friedrich Uhde GmbH. The plant will come into operation in March 1962, with an initial daily production of 460 tons of ammonia. The contract's value is given as DM 50 million (about £425 million).

The remaining section of the fertiliser plant—that for the production of ammonium saltpetre of lime—will be installed by Sindri Fertilisers Ltd.; it has not yet been decided what foreign company will be called in to advise on the erection of this plant.

A.K.U.'s Agreement with Mexican Rayon Manufacturer

Algemene Kunstzijde Unie N.V. (A.K.U.) have announced an agreement with Celulosa y Derivados S.A. (C.Y.D.S.A.) of Monterrey, Mexico, for the manufacture of rayon textile and tyre yarns in Mexico. A.K.U. are to make their know-how available to C.Y.D.S.A. on agreed terms, as well as providing technical assistance in the future.

U.S. Laboratory Sends Out 37% More Isotopes

The amount of radioisotopes shipped from the U.S. Atomic Energy Commission's Oak Ridge National Laboratory for use in the peaceful applications of nuclear energy increased 37% during 1958.

The amount despatched in 1958 also represents 37% of the total radioisotopes sent out from the laboratory during the 12 years that the programme has been under way.

A total of 288,717 curies of radioisotopes was despatched during 1958, compared to 166,652 curies during 1957. A total of 614,565 curies have been sent out from the laboratory since the radio-

isotopes programme was started on 2 August 1946.

While the total quantity of radioactive units sent out increased sharply, the number of despatches for 1958 showed only a slight increase from 1957. This resulted largely from the increased size of individual despatches to private firms which were making further distribution to ultimate users and from larger individual despatches of cobalt 60, cesium 137, iodine 131 and phosphorus 32.

Sales returns decreased from $2,599,284 in 1957 to $2,438,169 in 1958, reflecting a reduction in prices for cobalt 60.

Of the 1958 despatches 552, valued at $467,917, went to some 28 foreign countries, with Japan receiving the largest number.

During late 1958 the laboratory began first despatches from the multicurie fission products pilot plant, a chemical processing facility for recovery of usable radioisotopes from reactor fuel element processing wastes. The first material from the new plant was used as part of a 2,000 curie cesium-137 source for a teletherapy machine at a California medical research centre.

Czechoslovakia Increases Chemical Production

Czechoslovakia last year produced 463,000 tons of sulphuric acid, 4% more than in 1957. Other production figures, given by the State statistical office, are: nitrogen fertiliser 108,000 tons (46% more); phosphorus fertiliser 117,000 tons (6%); artificial fibres 55,000 tons (14%); petroleum 355,000 tons (14%).

Dutch May Build Fibre Plant in U.S.S.R.

The Dutch chemical fibre producers Algemene Kunstzijde Unie are considering the possibility of participating in the erection of certain yarn and fibre plants in the Soviet Union, from which some of their directors have just returned after a study tour of the synthetic fibre industry. The Russian policy of placing large orders for chemical plant with Western countries has led to negotiations now taking place between Soviet representatives and the Italian Snia Viscosa company on the erection of a large rayon factory in the U.S.S.R.

Hoechst Patent Novel Route to Ethanol and Isopropanol

Preliminary patent (DAS 1,035,632) obtained by Farbwerke Hoechst A.G. details a novel method for making ethanol and isopropanol. Ethylene or propylene is absorbed by 68 to 72% (by weight) sulphuric acid in a tantalum-plated countercurrent column at 20 to 40 atmospheres and 140° to 160°C (for ethylene) or 70° to 110°C (for propylene). Water is then added in an equal amount to the alcohol concentration—7% for ethanol or 20 to 30% for isopropanol. The alcohol is recovered by vacuum stripping in two stages, giving concentrated alcohol in the first, low concentration in the second operation.

Total yield of alcohol is stated to be over 96%, based on the starting olefin. The sulphuric acid at the end of the process is said to be at nearly the same concentration as the input acid, thus eliminating costly reconcentration.

New Anthraquinone Process Developed by Cyanamid

American Cyanamid's capacity for producing the dye intermediate for anthraquinone is to be doubled. A new process for producing anthraquinone will be used. The plant will make Cyanamid the U.S.'s first commercial producer of naphthaquinone, and will provide it with additional capacity for methylanthraquinone and phthalic anhydride. The process which has been developed in the company's research laboratories utilises direct oxidation of naphthalene in a fixed-bed catalytic converter. (Anthraquinone could be obtained from naphthaquinone by condensation with butadiene).

Rumania Negotiating for Chemical Equipment

The Rumanian Government announces that it is negotiating with the West German firms of Lurgi and AEC, as well as British, Swiss and Austrian firms for equipment for the chemical, oil and other industries.

Anhydrite Sulphuric Acid Project for East Germany

For the building of an anhydrite sulphuric acid plant at Losing, on the River Elbe, the East German Government has set aside 136 million East Marks. Production will begin when the first stage of construction is completed in 1960. Full production is expected to be 220,000 tons of sulphuric acid annually, with the same quantity of Portland cement as a subsidiary product.

Eire To Have New Superphosphates Plant

A new company is to be formed in Eire to manufacture superphosphates, it is reported. Pyrites from mines in County Wicklow, will be processed to provide sulphuric acid which will be used with rock phosphate to produce superphosphates.

Chemical Expansion in Colombia

A plant for the production of sodium silicates is expected to go on stream in the near future in Colombia. Production will reach about 9,000 tons a year, which would more than meet local needs. A factory for the manufacture of calcium carbide is in the planning stage based on designs submitted by a European organisation of engineers.

Canada West's Biggest Uranium Producer

Figures just released show that last year Canada doubled her 1957 uranium output to become the leading uranium producer in the Western world with an annual total of 13,537 tons. The U.S., hitherto the top producer of the West, produced some 12,560 tons and South Africa took third place with 6,200 tons. No figures have yet been issued for the production of the Soviet Union.

Gallium Manufacture in Hungary

An experimental plant is to be constructed shortly in Hungary to produce about 33 lb. of gallium a year as a by-product of alumina production.

New General Electric Process Produces Foams of Nickel Copper, etc.

ALTHOUGH still in the pilot plant stage General Electric have developed a process whereby foams of nickel, copper and cast iron can be produced.

The method used for foaming the metals is similar, G.E. state, to that used for making thermosetting foamed plastics. An organic resin is mixed with a standard foaming agent that releases nitrogen or carbon dioxide. Metallic powder is added and the mixture is baked in an oven. Heat releases the gas, which foams the metal to a point that depends on the predetermined amounts of materials. Density can also be controlled by the amounts of materials used. Thus nickel with a specific gravity of about 9 can be made into a foam with specific gravity ranging from 1 to 4. Strength of the foam is proportional to the density. The foams can be moulded during the baking stage into almost any shape desired and conventional tools can be used to machine them.

In the laboratory experimental work nickel in an alloy—F-alloy—has been used. A foam of this makes rubbing seals for high temperature areas of jet engines. Engine performance is improved, since the foamed metal has a lighter weight, which means more fuel or cargo can be carried, and the foamed metal makes possible closer tolerances inside a jet engine than solid materials.

Foamed metal, it is suggested, has potential applications for labyrinth seals and high temperature filters. The foam's high surface area and cell construction would enable it to be used for cooling and insulating (e.g. thermal insulators, transpirational cooling devices, etc.). Large electrical installations could use foamed copper since this material has been found to have the same capacity for electrical conductivity per unit weight as solid copper. The natural cooling action of foamed copper, plus small amounts of cooling air appear to increase the capacity of foamed copper to carry electricity.

EQUIPMENT REVIEW

Electronic Control Instruments : Pumps and Compressors : Safety Devices

RADIOGRAPHIC ISOTOPE CONTAINER

A NEW range of isotope containers for gamma radiography is announced by **R. F. Fraser-Smith,** 69 Kings Cross Road, London W.C.1. They have been designed to hold the activities commonly used in radiography.

The standard container, weighing about 30 lb., is for iridium 192 or caesium 137. It has been designed to give a maximum radiation level of 7.5 mr/h. at surface, when loaded with 2½ curies of iridium 192. Even when loaded with 2½ curies of caesium 137, the radiation level would be 7.5 mr/h. at only 10 in.

A smaller version for thulium 170, which will shortly be available in higher activities than before weighs only 8½ lb. With care it could be used by experienced operators for iridium 192, since the radiation would not exceed 7.5 mr/h. at one metre, when loaded with 2½ curies; the low weight would cause less fatigue. The container can be opened from a distance, by using the handling rod.

A third model for cobalt 60 will be available later. This will weigh about 70 lb., and is designed to give a radiation level of 7.5 mr/h, at one metre, when loaded with 2 curies.

The simple lightweight handling rod is suitable for all these containers; standard length is 3 ft., but it can be supplied in any length required.

Provisional prices, ex-works, are: 8½ lb. container £21, 30 lb. £25, 70 lb. £650.

DRUM OPENING TOOL

NOT previously available in this country, and now being manufactured here, the Powell drum opening tool is designed to remove heads from steel drums, which it does quickly, cleanly, and safely, even in the case of heavy gauge material. A clean cut is made close to the inside edge of the drum. The cutter blade is drop forged and heat treated and is detachable for occasional sharpening or replacement. The makers are **Powell and Co.,** 'Drum Master' products, Burry Port, Carms, South Wales.

ELECTRONIC STRIP-CHART RECORDER

THE Mark 3 Multelec high-speed electronic strip-chart indicator-recorder (hitherto confined to nuclear-energy and other special applications) has been added to the general industrial range of **Geo. Kent Ltd.,** Luton, Bedfordshire. The Mark 3 is at present available for the precision measurement of millivoltage, and also temperature, in association with thermocouple, resistance thermometer or radiation pyrometer.

Features include an operating speed—with no pointer 'overshoot'—of two seconds only for full-scale travel; all-mains operation with continuous standardisation; re-designed chart-drive unit, permitting variation of chart speeds from 1 in. per hour to 4 in. per minute; 10 in. chart width and pen travel; extremely sensitive, high-gain amplifier, covering a wide range of a.c. or d.c. input conditions; sealed-unit maintenance-free servo-motor with built-in tachogenerator; and a synchronous converter capable, it is claimed, of detecting smaller signals than any other available. The last three components are available for other applications as separate units.

The Mark 3 Multelec is available in single- or multi-point form, with point-cycle times of 5, 10 or 20 seconds, depending on application, enabling up to sixteen variables consecutively to be measured and recorded.

DIFFERENTIAL "63-INCH" INCREMETER

AN incremeter from the **Sensitive Research Instrument Corp.,** whose export agents are Ad. Auriema Inc., 85 Broad Street, New York 4, combines a differential instrument of high comparison accuracy with a highly stable reference source. The actual scale length of 6.3 in. represents only 10% of its total effective scale. Each 10% of its full scale range is selected by an incremental switch. Since there are 10 increments (going from 0 to 0.1, 0.1 to 2, etc., up to 0.9 to 1) any 10% of the full scale range is expanded over a full 6.3 in. scale length. A 100 division scale becomes a 1,000 division scale in which each division represents 0.1 to 1% of its full scale range. The incremeter is a direct reading instrument requiring no balancing, nulling or standardising operations. Features are—type: double-pivoted permanent magnet, accuracy 0.05 of 1% of full scale range, sensitivity: 200 microamps (0.2 microamps/division) to 10 amps and 200 millivolts (0.2 millivolts/division) to 1,000 volts full scale, availability: single range or switch-controlled multirange models for portable or rack mounting. Typical multirange combination—code SUPRES 1/10/100/1,000 volts (1,000 ohms/volt), 1/10/100/1,000 milliamperes, scale: hand-drawn, mirrored, 1,000 divisions, length 63 in. (edgewise panel instrument for rack mounting scale length 70 in.), readability 0.01% of full scale range, repeatability: 0.1% or better, power input: 95-135 VAC 60 cycles; 25 va.

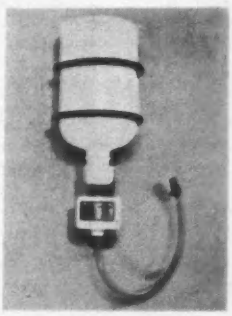
LIQUID LEVEL CONTROLLER

DESIGNED primarily to maintain a constant level in the fountain solution tray of lithographic presses, the new liquid level controller model No. 614, manufactured and marketed by **Liquid Systems Ltd.,** Norwich Union House, Welles'ey Road, Croydon, can be used with all types of liquids wherever a constant level is required to be maintained.

As all parts coming into contact with the solution are resistant to corrosive action, the flow to the tray cannot be restricted through eroded deposits and frequent flushing of the feed is obviated.

A 1-gall. polythene bottle holding the liquid is fitted into a mild steel holder designed to carry the whole weight of the bottle without any strain being transmitted to the valve. The bottle holder is secured to the main bracket but can easily be removed to enable the unit to be fixed to the machine. This is accomplished by fixing two set screws through the bracket, slotted holes being provided to enable slight adjustments in level to be made.

The reservoir cup is p.v.c. coated aluminium and is fastened to the aluminium main bracket.



Liquid level container

The valve is spring loaded to prevent loss of fluid when inverting the container, and opens automatically when the container is replaced in position in its holder. All valve parts are in stainless steel, any other parts coming into contact with the fluid being either stainless steel, polythene or p.v.c. coated aluminium.

The unit is supplied with 5 ft. of polythene tubing, two stainless steel hose connectors and worm drive clips. A brass adaptor is also provided for brazing to the tray of the machine.

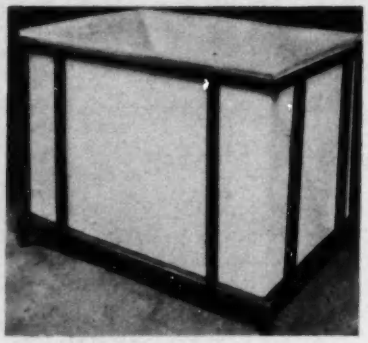
100 GALL. POLYTHENE TANKS

White, Child and Beney Ltd., Shepley Works, Audenshaw, near Manchester, are marketing moulded polythene tanks up to 60-gall. capacity. A 100-gall. model will be available shortly.

The tanks are made either in flexible polythene or in high density polythene (rigid grade), and are free standing in the latter quality. They are moulded in one piece and are particularly suitable for the storage of alkalis, salt solutions and most acids.

The steel holders are made to be virtually indestructible and are supplied primed and painted or polythene coated. Stainless steel holders are also offered.

Other models available include a range



A 60-gall. tank with steel holder and frame

of bins from 6-gallon to 50-gallon capacity, with or without lids and trays and boxes or small tanks in a wide selection of sizes.

MIXER AGITATOR DRIVE

THE newly formed U.K. mixer division of **Stockdale Engineering Ltd.**, Poynton, Ches., says it has developed the first British range of spiral bevel agitator drives designed specifically for fluid mixing applications.

There are five standard units in the range for both open and closed tank operation, and the drive assembly can be 'tailor-made' to meet highly specialised process requirements. The unit has been designed to give continuous, maintenance-free operation.

The agitator shaft which transmits power from the prime mover to the impeller has been designed for maximum rigidity and minimum deflection between bearings. For this reason long overhung shafts can be used at speeds higher than usual without approaching the critical or shaft whirling speed which can set up excessive vibrations and is the cause of most mechanical difficulties in the operation of mixers.

Spiral bevel gears, generated by the Gleason technique, are used for efficiency, long life and quiet operation. Variable mixing speeds are required in some processes and for this reason helical-spur 'pick-off' input change gears are fitted, and these can be changed without removing the drive or impeller shaft assembly from the vessel. Access is gained by removing the gear casing and no special tools are required.

A combined splash and pump-fed lubrication system provides a constant controlled supply of lubricant to the bearings and gears. Oil is retained in the gearbox by a drywell to prevent it from running down the shaft into the product.

FLOATING SUCTION STRAINER

THE Dolphin floating suction strainer, developed and produced by **Megator Pumps and Compressors Ltd.**, 43 Berkeley Square, London W.1, will be useful to users of pumps that draw from streams, ponds and sumps or are employed for dewatering mines, quarries and excavations.

The problem is to draw the water from just below the surface without drawing in sand, silt or floating matter.

Another problem to which the Dolphin strainer promises a solution is the tendency for air to be entrained into the pump suction through vortex formation. Experience to date has indicated that the Dolphin strainer prevents the formation of vortices, first, by reason of the cylindrical disposition of the entry holes and, secondly, because any tendency to vortex formation is automatically countered by a slight sinking of the strainer so that a vortex-free position of equilibrium is established.

The ordinary type of strainer, which sinks to the bottom, is said to allow fine solids to be drawn into a pump and owing to its weight, gets buried, sometimes completely, and, blocking the suction line, produces cavitation erosion.

The Dolphin strainer is made in four sizes, for 1½ in., 2 in., 3 in. and 4 in. hoses.

To prevent the twisting action of the hose turning the strainer out of its correct position the tube to which the hose is directly attached can rotate freely in the body of the strainer.

The float chamber is filled with a moulding of expanded polystyrene foam so that buoyancy cannot be lost through accidental damage.

In conditions where there is not sufficient depth of water for the pump to float it still tends to keep its upright position regardless of twisting of the hose end, as the bottom of the strainer is flat. All the entry holes are in the sides and the strainer is extremely light; there is no tendency for it to sink or to be sucked down into the sand or silt on which it may be resting.

The Dolphin strainer is constructed from plastics and austenitic stainless steel.

HYDRAULIC PALLET TRUCK

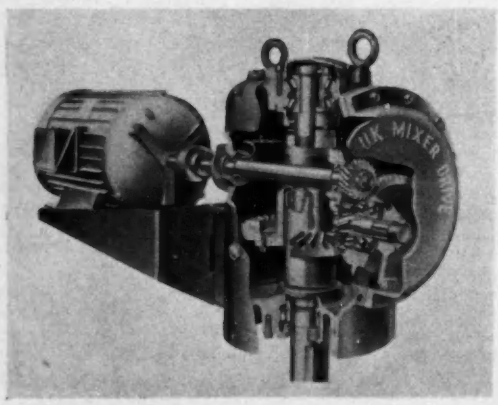
THE BT pallet truck manufactured in Sweden, is now available in the U.K. through the sole distributors, **Rotatruc Ltd.**, 20 Old Compton Street, London W.1.

This hand operated hydraulic lift truck has a capacity of 2,400 or 4,400 lb. Widths range from 20½-in. to 27-in. The forks are one-piece stampings available in standard lengths of 36, 42 and 48 in. Non-standard widths and lengths can be provided at a small additional charge. The height of the forks from ground level in the lowered position is 3½ in., which can be raised to an overall height of 8 in. with a few strokes of the steering handle.

Rotatruc with carboy load

It is claimed that the hydraulic unit is entirely leakproof in construction; even if the truck is turned completely over the hydraulic oil cannot escape. A special type of plastics packing with extra hard wearing characteristics is used in the hydraulic pump.

The wheels and fork rollers are made of steel or are available with hard rubber treads. Alternatively, wheels and rollers can be supplied made of nylon-reinforced Bakelite. They can be used on floors contaminated by grease, oil and most chemicals. The wheels can be pivoted through an arc in excess of 180 degrees.



Stockdale mixer agitator drive for fluid mixing applications

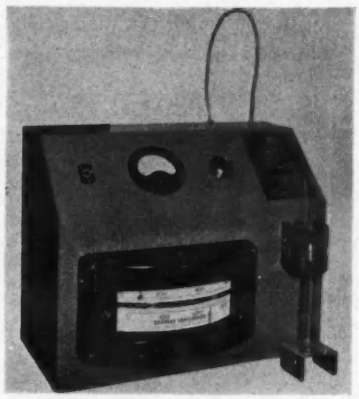
AUTOMATIC DISTILLATION APPARATUS

A RECENT introduction to the range of test equipment for the petroleum industry made by **F. J. Hone Ltd.**, 19 Eldon Park, London S.E.25, is the BP-Hone automatic distillation apparatus made under licence from the British Petroleum Co. Ltd.

This apparatus is based upon a rapid distillation method for the routine testing of refinery products when the value of a single point on the distillation curve provides sufficient information for day-to-day volatility control. Repeatability is said to be better than by standard methods. The apparatus is entirely

automatic and carries out a distillation in a matter of minutes—an operation which normally takes the best part of an hour.

Its method of operation is briefly: 10 millilitres of the sample to be tested is introduced into a flask by means of a pipette. A thermocouple is inserted into the neck of the flask and the receiver is placed in position. The heater is then



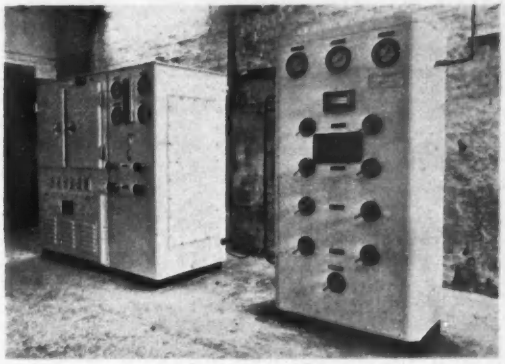
Automatic distillation apparatus

switched on (using voltage appropriate to the product) by operating button. When the selected temperature is reached an automatic cut-out switches off the heater. The volume of the distillation to the nearest 0.05 ml. is then noted, after allowing half a minute for draining. After each distillation the residue in the flask is removed by suction. The complete operation takes no longer than 10 minutes, of which less than three minutes is operator's time.

INDUCED-DRAUGHT COOLING TOWER A SYSTEM of packing for induced-draught cooling towers aiming at providing the greatest possible degree of heat transference with low capital outlay has been developed by **Film Cooling Towers (1925) Ltd.**, Kew Bridge, Brentford, Middlesex. This system, known as film flow, distributes the liquid evenly over the packed area of the tower and gives the cooling air unimpeded access to all parts of the packing.

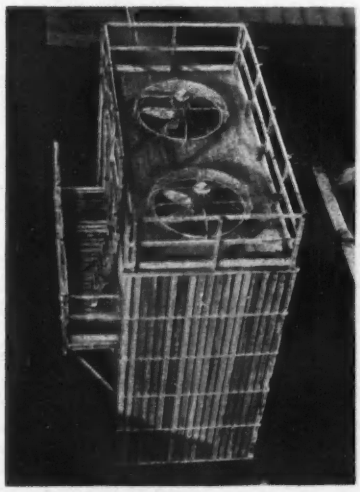
The water is led to the tower either in a closed pipe or in an open culvert from which it is discharged into secondary troughs through orifices designed to prevent splashing. From the secondary troughs it is fed into weir type spreader troughs running the entire length or breadth of the tower at a pitch of 6 in. The spreader troughs, which have specially shaped notches at 2 or 4 in. intervals, rest on the top layer of the tower filling. The filling is composed of a number of horizontal trays of parallel laths, the direction of each layer of laths being at right angles to the trays above and below it. The effect in plan view is of a grid composed of 2-in. square network and the water on being discharged through the trough walls flows down the grid packing in an even film changing direction through 90° in every 2 in. down the whole depth of the stack.

Refinery Equipment's self-contained nitrogen unit



This method of distribution ensures that the entire surface of the packing is evenly wetted, providing a very high heat exchange coefficient, which together with the fact that the cooling air has a relatively unimpeded flow throughout, effects an economy in the cost of the power to drive the fans. Also, by avoiding the formation of water drops, there is a smaller loss of water by entrainment and the use of baffle plates and drift eliminators is unnecessary.

The salient feature of the 'film flow' system, however, is the saving in space,



Film cooling towers

as the packing depth can be reduced in some cases by as much as 50% of the space required by the normal drip bar packing system. This is reflected in both lower capital costs and in considerable saving of the power required to obtain the pumping head.

SMALL NITROGEN PLANTS A RANGE of small, compact and completely self-contained plants for the supply of liquid or gaseous nitrogen, has been developed by **Refinery Equipment and Speciality Co. Ltd.**, Valley Works, Monton Road, Eccles, Lancs, to the design of H. E. Charlton Engineers Ltd. Five models are available which between them cover capacities from 1.5 to 24 litres of liquid nitrogen per hour or 2 to 30 standard cu. metres (70 to 1,000 sq. cu. ft.) of gaseous nitrogen per hour.

These plants are designed to produce nitrogen of up to 99.9% purity by the liquefaction and fractional distillation of air. By virtue of their sizes, weights and capacities they are suitable for use in tropical and isolated areas where supplies of nitrogen are not readily available from other sources. Applications include the provision of liquid nitrogen for petroleum gas analysis on remote oilfield sites and liquid or gaseous nitrogen for general laboratory, refinery and chemical works usage.

All R.E.S. Co. nitrogen plants comprise four principal sections which carry out the following functions: 1—compression of the incoming air, 2—removal of carbon dioxide, 3—drying, 4—condensing and subsequent separation of nitrogen by fractional distillation.

Regenerative driers, a caustic soda scrubber, and cross counter-current heat exchangers are used with the aim of achieving long trouble-free runs. The drying and separation sections are each housed in stove-enamelled cabinets. Foundations are required for the high pressure multi-stage compressor and caustic soda scrubbing tower but these units can be housed in positions remote from the other two.

The plants are fully instrumented, completely wired up electrically and only require interconnecting pipework and electricity supply cable to be installed by the user.

In Parliament

Decision on Disbanding of Microbiology Group

Mr. H. Nicholls, Parliamentary Secretary to the Ministry of Works, was asked on 24 February why the research council of the Department of Scientific and Industrial Research in its consideration of the dispersal of the microbiology group did not seek the advice of the advisory committee which had been attached to the group, or the Institute of Biology.

He replied that the research council were fully aware of the advisory committee's views before they took their decision. They did not consider it necessary to consult any additional bodies.

Commercial News

- **B.O.C.'s £24 m. Capital Spending Programme**
- **Ilford Chairman on Co-operation with I.C.I.**
- **Record Profit for Hickson and Welch Ltd.**
- **Degussa Report Turnover Increase of 5%**

British Oxygen

Under-activity in many spheres of heavy industry and general engineering is stated by Mr. J. S. Hutchinson, chairman of British Oxygen Co. Ltd., to be reacting on the company's gas business. Sales and profits overseas, however, are on the up-grade. Profits generally are expected to bear a favourable comparison with those of the year to 30 September 1958.

Group turnover in 1957-58 rose by 15.7% and the net profit advanced from £2,748,986 to £3,334,062. As was announced earlier (see CHEMICAL AGE, 21 February, p. 333) dividend is being maintained at 10% and a special interim of 2% has been declared in respect of the current year.

Conservation of resources must have priority when large capital expenditure lies ahead, Mr. Hutchinson stresses, but he adds that the past year gave the company expanded turnover and an improved balance of available profit. Year-end commitments amounted to £2.85 million. The group capital expenditure programme for the three years 1958-61 at present totals £24 million which the company expects to come from its own resources, without it needing to issue further capital.

In the first quarter of the current financial year, industrial gas sales of the U.K. Gases Division have been somewhat below those of the corresponding period a year ago and there is as yet no indication of resumption of the upward trend. Chemicals Division's sales and profits are not expected to reach last year's levels and the tempo of future advance may be restrained. Group fixed assets expanded from £37,155,136 to £40,504,079. Current assets are £23,689,527 (£23,423,271) and current liabilities total £10,845,392 (£11,086,682). Reserves amount to £14,646,118 (£12,735,282).

Ilford Ltd.

The outstanding event of the year was the arrangement made for co-operation with Imperial Chemical Industries Ltd., the Hon. James P. Philipps, chairman of Ilford Ltd., says in his annual statement. Their laboratories were working at high pressure to take full advantage of the information and assistance available from I.C.I. They hoped to introduce new colour products soon and so extend their range of colour films. As already reported, the dividend of 16% has been maintained.

Hickson and Welch (Holdings)

A good start for the first four months of the current year was reported by the chairman of Hickson and Welch (Holdings) Ltd., Mr. H. B. Hickson, who said he looks forward to results being comparable to those of the year to 30 September 1958. Giving a review of the progress of individual companies, he said Hickson and Welch Ltd. had attained the highest profit in their history. Capital expenditure was greater than at any time before, processes had been improved and eight more products had been added to the range. A further 12 acres of land had been bought. As already reported (CHEMICAL AGE, 31 January) a dividend equivalent to 12 3/10% was paid for the year ended 30 September 1958.

Revertex Ltd.

With a final of 17½%, Revertex Ltd., manufacturers of concentrated rubber latex and synthetic resin emulsions, are maintaining a 30% dividend for the year ended 30 September 1958. It is proposed to make a one-for-two scrip issue and to double the authorised capital to £1 million. Net profit was £178,373 against £190,975 after tax of £219,000 (£216,000).

Simon-Carves

Simon-Carves are paying a special distribution out of realised capital profits of 4½d per 5s share on 3 April. This distribution is exceptional and will not affect whatever final dividend may be recommended in respect of 1958.

Degussa

An increase of 5% in turnover was reported in the annual statement of Deutsche Gold- und Silber-Scheideanstalt. Profits, however, did not keep in step with the increased turnover. One third of turnover represented exports. Sales of oxidising and bleaching agents were not entirely satisfactory, largely because of worsening conditions in the textile industry, and exports were lower. Production capacity for cyanides and prussic acids was fully used.

Sales of methanol derivatives in the home market remained at the previous year's level and the export price struggle continued. Efforts were being made to obtain additional outlets for sodium metal. Plants and parts for the manufacture and processing of uranium were sold both to European countries and to Japan and South America.

Prussic acid was made by two processes and efforts were being made to open up new fields of application for prussic acid. A new plant for cyanuric chloride was taken into service. Output of uranium metal on a pilot scale reached its intended level. Net profit for 1957-58 was DM 14,289,259.04 and a dividend of 14% was declared.

Unilever

Unilever Ltd. and Unilever N.V. had a combined turnover in 1958 of £1,728 million, an increase of £8 million. Net profit was £47.3 million (£40.3 million).

Unilever Ltd.'s final dividend is 2s. 1.2d. per £1 unit, against 2s. 3.6d., making 4s. 2.4d. per unit (3s. 6d.) Unilever N.V.'s dividend is 9¼% (10½%), being the equivalent of the Unilever Ltd. dividend.

Market Reports

HOME TRADE ENQUIRY REPORTED BETTER

LONDON The demand for industrial chemicals has been sustained and a little more inquiry on home account has been reported. Export trade is keeping up to a good level and the firm tone which has characterised the markets for some months continues to be maintained. Interest has been fairly general with the soda products moving in good quantities, and there has been an active call for copper sulphate, borax, hydrogen peroxide and arsenic.

Sulphate of ammonia and other fertiliser materials have been in steady call, and activity in this market has been helped by the improved weather.

Business in the coal-tar products continues quietly steady with prices maintained. Pitch, creosote oil and cresylic acid have been fairly active on home and overseas account.

MANCHESTER Traders on the Manchester chemical market during the past week have reported a fair aggregate movement of the soda, potash and ammonia compounds, as well as a number of miscellaneous items, against contracts. Fresh bookings have been on a moderate scale and mainly for relatively near delivery positions. Shipping business keeps up at about its recent level. There has been little change of any consequence in the general price position, the undertone of the market being steady. Fertiliser materials, including the compounds, continue to be taken up in bigger quantities. Most of the coal tar products are in fair demand.

GLASGOW The trend of business during the past week on the Scottish heavy chemical market has shown little change. From most sections the trading position has remained steady, with quantities fairly well maintained. Prices have been firm with little change. The position in regard to agricultural chemicals is still one of seasonable quietness, but some more interest is now being shown.

PEOPLE in the news

● MR. E. W. M. FAWCETT, technical director, and MR. H. P. P. HODGKINS, commercial director of Howards of Ilford Ltd., have been appointed to the board of the parent company, Howards and Sons Ltd. Mr. Fawcett joined Howards of Ilford in 1955 and Mr. Hodgkins in 1956.

● The president of the Association of Chemical Industry of West German, DR. ULRICH HABERLAND, has been voted unanimously to the post of president of the International Secretariat of the Associations of Chemical Industry. Voting was by the presidents of the associations within the Common Market area. The S.I.I.C., which sits in Brussels, is a body dealing with the interests of the chemical industry within the Common Market.

● MR. C. B. EVANS has been appointed to the board of Midland Silicones Ltd. He joined the company in 1955 as works manager at Barry, South Wales—the largest silicone manufacturing plant in Europe. He had been production manager for Peter Spence and Sons Ltd., Widnes, and before that was for 13 years with the General Chemical Division of Imperial Chemical Industries, both at Thornton and Widnes. Mr. Evans is a native of Cardiff and graduated in chemistry and metallurgy at Cardiff University College. In 1956 he spent some time in the United States at the Midland (Michigan) headquarters of the Dow Corning Corporation, with whom Midland Silicones are associated.

C. B. Evans

● DR. T. CORLETT MITCHELL, deputy chairman of I.C.I. Central Agricultural Council, who has had over 30 years' service with I.C.I., 22 of them at Billingham, is retiring at the end of this month. He went to Billingham as a chemist in 1928. He is also on the board of Scottish Agricultural Industries Ltd., an I.C.I. associate.

● MR. W. R. BESWICK has retired from the board of the Power-Gas Corporation Ltd.

● Ill-health prevented MR. P. MURPHY, chief chemist in the development division of John Laing and Son Ltd. from lecturing on 'Corrosion of metals in buildings' at a recent meeting of the Bradford Telford Society.

● MR. JOHN YORWERTH has been appointed marketing controller of Benger Laboratories Ltd. Mr. Yorwerth joined Benger nearly six years ago as a medical representative. He subsequently set up and controlled the public relations department before being made generally responsible for company publicity. Prior to his new appointment he served as sales manager. As marketing controller, Mr. Yorwerth will be responsible for all promotional and marketing aspects of Benger products throughout the world. MR GORDON MCALPINE has been appointed to the newly created position of field manager.

● An honorary LL.D. is to be conferred on SIR HUGH BEAVER, president of the Federation of British Industries and the Institution of Chemical Engineers by Dublin University. An honorary Sc.D. is to be conferred on PROFESSOR E. L. HIRST, Professor of Organic Chemistry, Edinburgh University.

● DR. JOSEPH EDISBURY, Ph.D., D.Sc., 14 Glan Aber Park, Chester, recently elected chairman of the North of England Section, Society for Analytical Chemistry, was educated at Liverpool College and Liverpool University. His post-graduate research on a four-year Medical Research Council grant was carried out under Professor R. A. Morton, mainly on spectroscopy applied to biological problems. He joined Unilever's research department at Port Sunlight in 1938 to start a spectroscopy laboratory working on the first semi-quantitative test for vitamin A in early wartime 'dyed' margarine. Dr. Edisbury is now a technical editor. With W. H. Storey he is a co-founder of the Photoelectric Spectrometry Group. His publications have been mainly on spectroscopy with later emphasis on accuracy of assay and, he says, its delusions.

Dr. J. Edisbury

● MR. T. F. HURLEY, O.B.E., who recently retired from the position of chief research engineer at the Fuel Research Station has joined the National Industrial Fuel Efficiency Service.

● MR. JAMES SIMPSON, deputy chairman of the Woodall-Duckham Construction Co. Ltd., has been appointed deputy chairman of Woodall-Duckham, the parent company of the Woodhall-Duckham group.

Mr. J. F. Willsher, who has been appointed general works manager of Geo. Kent Ltd. He has been production controller, production manager and instrument division manager

● SIR ALEXANDER FLECK, chairman of I.C.I. has agreed to accept the presidency of the Industrial Co-partnership Association. This office was previously held by the late Viscount Cecil of Chelwood. Deputy president of the association is Mr. D. Heathcoat Amory, the Chancellor of the Exchequer, and the chairman is Sir Geoffrey Shakespeare.

● MAJOR K. M. CAVE, in charge of method study for British Drug Houses Ltd. with whom he has worked for 30 years, will be the new Mayor of Finchley, London, in May. A Finchley councillor for the past nine years, Major Cave has been nominated by the Conservative majority group.

● Nominated as president-elect of the Royal Institute of Chemistry for the years 1959-61 is MR. E. LE Q. HERBERT. He will take office in April. Mr. Herbert is managing director of the Shell Refining Co. and a director of the Shell Chemical Co., Trimpell, and the Associated Ethyl Co. He is also a fellow and vice-president of the Institute of Petroleum, a member of the Institution of Chemical Engineers, and a member of the Institute of Fuel.

E. Le Q. Herbert

Obituary

DR. R. B. FORSTER, aged 80. Dr. Forster retired in 1948 from the post of technical adviser to the Delhi Cloth and General Mills Co. After education in Dublin he had works practice from 1900-1905 in Canada and the U.S. Between academic appointments in Ireland, Germany, England and India he had five years, 1916-1921, with British Dyestuffs Corporation Ltd. as research and works chemist and liaison officer with the production control department.

At Middlesbrough, after a car accident, COL. ALEXANDER WALLIS WEIR, personnel manager, I.C.I., Wilton, aged 52. He joined the firm in 1938 at Welwyn as an engineer. After serving in the war, he was transferred to Billingham as works manager of the Perspex plant. He was afterwards manager of the plastics plants at Billingham and Wilton, and became personnel manager at Wilton in 1950.

TRADE NOTES

Silicone Aerosol

Savings in cost of at least 30% are claimed for a 16-oz. silicone aerosol marketed as Solvosil by Solvolene Lubricants Ltd., Reginald Square, London S.E.8. The saving has been brought about by using a new valve and a larger container enabling more silicone and less propellant to be used. The propellant is Arcton.

Instrument Show

Fifth international instrument show staged by B. and K. Laboratories will be held at 4 Tilney Street, Park Lane, London W.1, from 6 to 10 April. Electronic instruments from over 50 factories in 10 countries will be shown.

New X-ray Developers

Two new phenidone-hydroquinone developers for use with all types of X-ray materials have been introduced by Ilford Ltd., Ilford. Phenisol, supplied as a concentrated liquid, can give either high or medium contrast by adjustment of the developing time. Phen-X X-ray developer is supplied in powder form and has a similar speed and low density contrast to Ilford ID-19, but has a higher high-density contrast. Both have good keeping qualities, give little stain on clothes and fingers and are unlikely to cause dermatitis.

New Projects at Exhibition

At least three new projects will be introduced at a two-week exhibition of products of Dexion Ltd., Maygrove Road, London N.W.6, at Stonebridge Park, Wembley, from 25 May. At the same time Dexion and Cheecol Processes Ltd. will officially launch their low-cost building scheme for overseas countries.

The exhibition will include all Dexion's standard products, Undulite translucent plastics and their new building products. There will also be displays of products marketed overseas by the Dexion subsidiary company, Petalon Ltd.

Thermocouple Wires

Relaxation of currency controls has made it possible to resume importation of Hoskins Chromel-Alumel thermocouple wires from the U.S., and R. G. McLeod Tools Ltd., Lavina Grove, London, N.1, are operating a "same-day" delivery service.

Instead of having a dull oxidised finish the wires will be bright. The makers claim that in addition to saving time by making scraping of the oxide film unnecessary the new wires will lead to greater accuracy.

P.T.F.E. Insulated Instrument Wire

P.t.f.e. instrument wire for use in electrical instruments and equipment is now available from Siemens Edison Swan Ltd., 155 Charing Cross Road, London W.C.2. Initially, two types are available, for use at voltages up to 500 volts r.m.s. and 1,000 volts r.m.s.

Applications are expected to be wide, notably in the aircraft, chemical and electronic industries. The wire, for use where conductor temperatures of between −75°C and 250°C are experienced, has either single or stranded annealed copper wires each silver plated to a radial thickness of not less than 0.00003 in. The p.t.f.e. is extruded, permitting a high degree of concentricity to be obtained, and it offers complete chemical resistance to all known solvents, except molten sodium and fluorine gas.

Instruments Exhibition

Evans Electroselenium Ltd. will be showing a full range of photo-cells and photo-electric instruments with their galvanometers and microammeters at an exhibition of scientific instruments arranged by A. M. Lock and Co. Ltd., Prudential Buildings, 79 Union Street, Oldham, to be held from 17-20 March, at the Bennett Hall, Y.M.C.A. Centre, Snow Hill, Birmingham.

The products of a number of other companies will also be exhibited and it is expected that chemists, analysts, electronic engineers, etc., will all find something new and interesting. Tickets can be obtained from A. M. Lock and Co. Ltd., or Evans Electroselenium Ltd., Colchester Road, Halstead, Essex.

Changes of Address

The chemical sales department of British Celanese Ltd. is moving to Coventry from its present offices in London, and from 9 March will be at: 345 Foleshill Road, Coventry. Tel.: 88771. Telex Coventry 31538.

Steel Peech and Tozer, a branch of the United Steel Companies Ltd., have changed their address to P.O. Box 50, The Ickles, Rotherham, Yorks, telephone Rotherham 2181, telex 54209.

Hand Cleanser Dispenser

The Spenso hand cleanser dispenser for factory washrooms consists of a bracket plugged to the wall on which rests a 1-gall. can. The pump unit clips on to the bracket and down over the lip of the can and is tightened in position. The makers are Deb Chemical Proprietaries Ltd., Belper, Derbyshire.

P.C.C. in Ink Formulations

A booklet reviewing the use of precipitated calcium carbonate as pigment extenders in printing inks has been published by John and E. Sturge Ltd., Wheeleys Road, Birmingham 15.

The contents include a table summarising seven coated and uncoated grades—including Calofort, Calofil, Calopake and Sturcal.

I.C.I. Introduce Velan NW

I.C.I. Dyestuffs Division are introducing Velan NW to their range of textile finishing agents. Velan NW is an improved type of durable water-repellent finishing agent, which is also designed for application in resin finishing. In degree of water repellency and durability, Velan NW is comparable with Velan PF, but unlike it Velan NW needs no final washing-off treatment to develop its full effectiveness. At low dosages it assists in overcoming the adverse tear strength effects that can be an undesirable feature of resin finishes. At higher concentrations it enables combined water-repellent and crease resistant effects to be obtained.

Factory White Paint

Panolite factory white paint is described in a leaflet issued by P. and A. New Ltd., Ditchford Mill, Wellingborough, Northants. Prices are 36s a gall., 34s 6d a gall. in 5-gall. drums, subject to special discount for quantities.

Change of Name

Allied Chemical Co. Ltd., 14 Appold Street, London, E.C.2, have changed their name to B.A.C. (Machine Sales) Ltd.

DIARY DATES

MONDAY 9 MARCH

C.S.—Cambridge: Univ. Chem. Lab., 5 p.m. 'Elimination reactions of quaternary ammonium compounds and amine oxides', by Dr. J. McKenna.
C.S.—Durham: Univ., 5 p.m. 'Homolysis or heterolysis', by Dr. A. Maccoll.
C.S.—Leeds: Univ., 6.30 p.m. 'Gibberellic acid: a plant-growth promoter', by Dr. B. E. Cross.
C.S.—Leicester: Univ., 4.30 p.m. 'The role of chemical research in fermentation', by Dr. A. H. Cook.
Inst. Rubber Ind.—Manchester: Newton Heath Tech. Coll. 'Chemical plant lining', by Mr. J. L. F. Crompton.
S.C.I.—London: 14 Belgrave Sq., S.W.1, 5.30 p.m. 'Selectivity factors in flotation', by Dr. M. G. Fleming.

TUESDAY 10 MARCH

I.Chem.E.—Manchester: Coll. Sc. and Tech. Whole-day symposium on fluidisation.
R.I.C.—Hatfield: Tech. Coll., Roe Green, 7.30 p.m. 'Behaviour of lubricated surfaces', by Dr. D. Tabor.
S.A.C.—Nottingham: Gas Showrooms, 7 p.m. 'The microbiological assay of the B Vitamins', by Dr. F. W. Norris.
S.C.I.—London: 14 Belgrave Sq., S.W.1, 10.30 a.m. Potash meeting.
S.C.I. with C.S. abd R.I.C.—Aberdeen: Marischal Coll., 7.30 p.m. 'The triplet state in chemistry', by Prof. G. Porter.

WEDNESDAY 11 MARCH

B.A.C.—London: Wellcome Research Inst., Euston Road, N.W.1, 7 p.m. Film display.
C.S.—Dounreay, 5 p.m. 'The study of rapid chemical reactions', by Prof. G. Porter.
Plastics Inst.—Cardiff: Angel Hotel, 6.30 p.m. 'P.T.F.E.' (I.C.I.).
R. I. C. — Rochdale: Tech. College, 7.15 p.m. 'Modern plastics', by Mr. C. E. Hollis.
R.S.A.—London: John Adam St., Adelphi, W.C.2, 2.30 p.m. 'Some achievements of the International Geophysical Year', by Dr. D. C. Martin.
Royal Statistical Soc.—London: 28 Portland Pl., W.1, 6.15 p.m. 'Industrial market research', by Mr. L. A. Williams (Ferranti Ltd.).
S.C.I.—London: 14 Belgrave Sq., S.W.1, 6.15 p.m. Papers by members, food group.

THURSDAY 12 MARCH

C.S.—Bangor: Univ. Coll., 5.45 p.m. 'Nucleotides and bacterial cell-wall constituents', by Prof. J. Baddiley.
C.S.—London: Burlington House, W.1, 7.30 p.m. Irving Langmuir Memorial Lecture, Sir Eric Rideal.
C.S.—Bristol: Univ., 5.15 p.m. Dr. M. C. Whiting.
Plastics Inst.—London: Wellcome Foundation Building, Euston Rd., N.W.1, 6.30 p.m. 'International competition in the chemical industry', by Mr. S. P. Chambers.
R.I.C.—London: Chelsea Coll. Sc. and Tech., Manresa Rd., S.W.3, 7 p.m. 'Reaction mechanisms', by Prof. E. D. Hughes.
S.C.I. with R.I.C.—Wirral: Coll. of Further Educ., Carlett Park, 7.30 p.m. 'Applications of biology in industrial chemistry', by Dr. Magnus Pyke.

FRIDAY 13 MARCH

Oil and Colour Chem. Assn.—Liverpool: Constitutional Club, 6.30 p.m. 'Titanium oxide pigmented alkyd/amine systems', by Mr. H. D. Hibberd.
S.A.C. with R.I.C.—Swansea: Univ. Coll., 6.30 p.m. 'New trends in qualitative analysis', by Mr. D. W. Wilson.

SATURDAY 14 MARCH

S.A.C. with Assn. Public Analysts.—Leeds: Gt. Northern Hotel, 2.15 p.m. 'The composition of milk', by Mr. J. Markland.

LURE OF Ph.D. DISTORTS DISTRIBUTION OF BRITAIN'S RESEARCH STUDENTS

THE attraction of the Ph.D. degree may be providing an attraction which is distorting the distribution of research students in ways that are not in the nation's interest, Sir Harry Melville, secretary of the Department of Scientific and Industrial Research, said at the annual general meeting of the Association of Technical Institutions on 27 February.

"In some occupations the Ph.D. may have a cash value, and also in the minds of many young people the title of doctor may make some appeal to a very natural streak of human vanity," he said.

"Other establishments specialising in certain branches of technology and science (for example many technological institutions, the research associations and D.S.I.R.'s own stations) can offer a valuable research training, but no doctorate as a hall-mark of success in this training (except to the London graduate able to work for his Ph.D. externally).

"We must give attention to ways of encouraging students to take their research qualifications in a wider range of institutions than at present. It remains to be seen whether the newly-created Hives research qualification of 'Membership of the College of Technologists' will provide an award as popular as the Ph.D."

D.S.I.R., Sir Harry said, now had almost a monopoly for giving postgraduate awards in science and technology from public funds. A snowball effect might be expected as soon as a rise in research effort in the technical colleges raised the esteem in which their research training was held by graduates and vice versa.

D.S.I.R. did not insist on a degree for research students. There were alternative qualifications, and they had decided to accept the new Diploma in Technology.

They were trying to encourage students to spend at least one year of their postgraduate training abroad.

A N.A.T.O. scheme which D.S.I.R. was to administer in this country would encourage international exchanges and there was on the stocks a Commonwealth scholarship scheme, about which more would be heard.

New Store for Chemical Supply

Chemical Supply Ltd. are having a large storage building erected at their premises at Abbey Road, Barking, at a cost of £22,000.

Petrochemicals' Chimney Discussed in Parliament

THE application of Petrochemicals Ltd. for planning permission to erect a 300-ft. chimney at Parkington, raised difficult issues which were still being considered, said the Parliamentary Secretary, Ministry of Housing, Mr. J. R. Bevins, in the House on Tuesday.

He added that the main issue was whether that boiler plant and chimney, which was likely to discharge about 36 tons of sulphur dioxide a day, should be built in an area already polluted. An alternative possibility was that the sulphur should be removed by gas washing. All these considerations would be taken into account.

Cellophane Production Starts at Barrow

PRODUCTION of Cellophane cellulose film is starting at British Cellophane Ltd.'s new £3,000,000 factory at Sandscale, Park Road, Barrow-in-Furness, Lancashire. Parts of the plant are already operating and the factory will be in full production within the next few weeks. About 300 people will be employed.

The new factory is claimed to be the most up-to-date plant in the world for producing cellulose film transparent wrapping material. The plant has been planned so that additional production units can be conveniently added. About a half of the new output will be exported.

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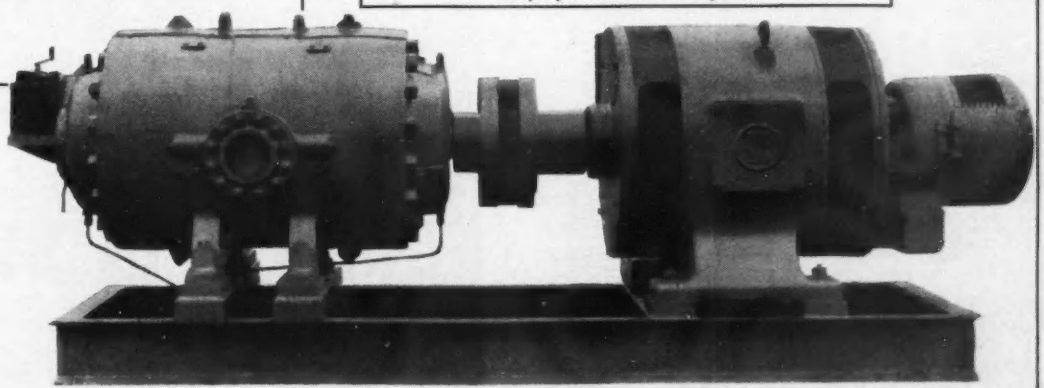

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Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 15 April

Biosynthesis of vitamins. Aschaffenburger Zellstoffwerke A.G. [Addition to 766 749.] **811 874**

Cyanine dyestuffs. Ilford, Ltd. **811 876**

Crystalline tripolyphosphate and method of preparing same. International Minerals & Chemical Corp. **812 083**

Process for obtaining alkali metal hydroxide solutions. Esso Research & Engineering Co. **812 084**

Paints based on portland cement. Associated Portland Cement Manufacturers, Ltd. **812 086**

Electrolising device. New Jersey Zinc Co. **811 881**

Baths for the electrolytic deposition of chromium. Kampschulte, H., and Farfsing, P. **811 882**

Sectional cooling tower having intermediate water redistribution means between sections. Marley Co. **812 031**

Uranium recovery from ores. U.S. Atomic Energy Commission. **811 890**

Fuel cells. National Research Development Corp. **812 091**

Process for the production of borides. Norton Grinding Wheel Co. Ltd. **812 092**

Water-insoluble quinazoline monoazo dyestuffs. Farbenfabriken Bayer A.G. **811 953**

Aldehyde monoperacylates. Distillers Co. Ltd. **811 893**

Esters of α-tocopherol. Merck A.G., E. **811 895**

2-Hydroxy-4-arylaminoquinolines. Geigy A.G., J. R. **811 957**

Formation of phosphate coatings. Pyrene Co., Ltd. **812 095**

Preparation of terephthalic acid. Henkel & Cie. G.m.b.H. **811 899**

Steroid compounds and a process for their preparation. Organon Laboratories, Ltd. **811 901**

Detergent compositions. Hedley & Co., Ltd., T. **811 902**

Synthetic lubricating composition. Esso Research & Engineering Co. **811 813**

Curing films of butadiene-styrene copolymers. Esso Research & Engineering Co. **811 903**

Synthetic resin bituminous coating compositions. Pittsburgh Coke & Chemical Co. **811 905**

Photographic emulsions. General Aniline & Film Corporation. **811 907**

Metal foam and method for making. Bjorksten Research Labs., Inc. **811 814**

Phenthiazine derivatives and their preparation. Soc. Des Usines Chimiques Rhone-Poulenc. **811 959**

Heterocyclic hydrazides. Farmaceutici Italia S.A. [Divided out of 811 780.] **811 816**

Polymerisation of ethylene. Soc. Des Usines Chimiques Rhone-Poulenc. **811 909**

Biologically active steroid compounds and process for the preparation thereof. Organon Laboratories, Ltd. **811 961**

Non-metallic ferromagnetic materials. Du Pont De Nemours & Co., E. I. **811 963**

Derivatives of the lysergic acid series and process for their manufacture. Sandoz, Ltd. **811 964**

Catalytic hydrogenation of acetylene. Engelhard Industries, Inc. **811 820**

Aromatic dicarboxylic acids and process for making same. Esso Research & Engineering Co. **811 967**

Culture medium for the production of spiramycin by fermentation. Soc. Des Usines Chimiques Rhone-Poulenc. **811 971**

Para - α-cumylphenol - para - substituted - phenol-formaldehyde resin. Allied Chemical Corp. **811 822**

Method of oxidising aluminium alkyls. Esso Research & Engineering Co. **811 976**

Production of axerophten. Badische Anilin- & Soda-Fabrik A.G. **812 097**

Disazo dyestuffs derived from diphenyl and their copper complex compounds. Farbenfabriken Bayer A.G. **812 102**

Unsaturated ethers and a process for the manufacture thereof. Hoffman-La Roche & Co., A.G., F. **812 106**

Dyeing of structures of linear aromatic polyesters. Badische Aniline- & Soda-Fabrik A.G. **812 109**

Reserpic acid derivative. Boehringer, A., Boehringer, E., Liebrecht, I., Liebrecht, J., and List, W. Mayer- [trading as Boehringer Sohn, C. H.]. **811 827**

Silver catalyst and method of manufacture. Dow Chemical Co. **811 828**

Fabrics and yarns from ethylene terephthalate polymers. Du Pont De Nemours & Co., E. I. **812 110**

Improving the dyeability of polyester fibres. Veb Chemische Fabrik Grünau. **812 111**

Preparation of perchloroethylene. Columbia-Southern Chemical Corp. **811 833**

Salts of penicillin G with amines. Soc. Des Usines Chimiques Rhone-Poulenc. **811 834**

Corrosion-resistant cobalt and/or nickel-base alloy. Union Carbide Corp. **812 113**

Method and apparatus for drying and cooling pellets, rubbery or plastics material. Firestone Tire & Rubber Co. **812 043**

Solvent extraction process. Esso Research & Engineering Co. **812 114**

Fluorinated polymeric materials. Du Pont De Nemours & Co., E. I. **812 116**

Process of producing imidazole derivatives. Osterreichische Stickstoffwerke A.G. **812 117**

Dithiophosphoric acid esters and insecticidal preparations comprising them. Sandoz, Ltd. **812 119**

Cycloalkyl derivatives of urea and herbicidal agents. Badische Anilin- & Soda-Fabrik A.G. **812 120**

5, 6-Dihydro-1, 4-oxazine-2-ones. Farbenfabriken Bayer A.G. **812 044**

Sulphinyl-phosphoric and -thiophosphoric acid esters. Farbenfabriken Bayer A.G. [Addition to 811 268.] **812 045**

Open to public inspection 22 April

Producing uranium tetrachloride. Carter, J. M. **812 121**

Apparatus for the transfer of granular or other finely divided solid material. Imperial Chemical Industries Ltd., Lipscomb, R., and Appleton, E. V. **812 189**

Method of electro-magnetically separating ionic isotopes. Thompson, R. W. **812 122**

Heat treatment of uranium. U.K. Atomic Energy Authority. **812 123**

Clarifying fermented liquor. Grindstedvaerket, A. S. **812 402**

Production of polymeric substances containing inorganic matter. Walker Extract & Chemical Co. Ltd. **812 126**

Removal of carbon dioxide and (where necessary) hydrogen sulphide from gases containing these constituents. Baumann, F. **812 134**

Treatment of highly olefinic hydrocarbon fractions. Hydrocarbon Research, Inc. **812 355**

Antibiotic composition. American Cyanamid Co. **812 138**

Production of solid polymers of ethylene and other olefin polymers. Phillips Petroleum Co. **812 139**

Linear copolymers. Rohm & Haas Co. **812 140**

Quaternary ammonium compounds and process for their manufacture. Ciba Ltd. **812 180**

Aromatic esters and pharmaceutical preparations containing them. Ciba Ltd. **812 360**

Process for producing black prints on fibrous materials. Farbwerke Hoechst A.G. **812 143**

Delignification and bleaching of cellulose fibres. Soc. Pour L'Amelioration et le Developpement Des Procedes Industriels Sadepi. **812 144**

Electrodeposition of chromium plate. Metal & Thermit Corporation. **812 337 & 812 338**

Manufacture of dyed and durably crimped fibrous materials of linear polyesters. Farbwerke Hoechst A.G. **812 362**

Ferroelectric ceramic compositions. General Electric Co. **812 344**

Process for preparation of starch phosphates. International Minerals & Chemical Corp. **812 339**

Pudding mix containing alkali metal starch phosphate. International Minerals & Chemical Corp. **812 363**

Derivatives of pyrimidine and the preparation thereof. Wellcome Foundation Ltd. **812 366**

Device and method for monitoring chemical etching processes. North American Aviation Inc. **812 367**

Process for preparing alkali metal starch phosphates. International Minerals & Chemical Corp. **812 340**

Process for reducing the sulphur content in iron and for economising in coke in cupola furnaces. Knorr-Bremse G.m.b.H. **812 410**

Diazotisation processes. Farbwerke Hoechst A.G. **812 368**

Esters of monothiophosphoric acid, process for preparation thereof and insecticidal compositions containing them. Candoz, Ltd. **812 369**

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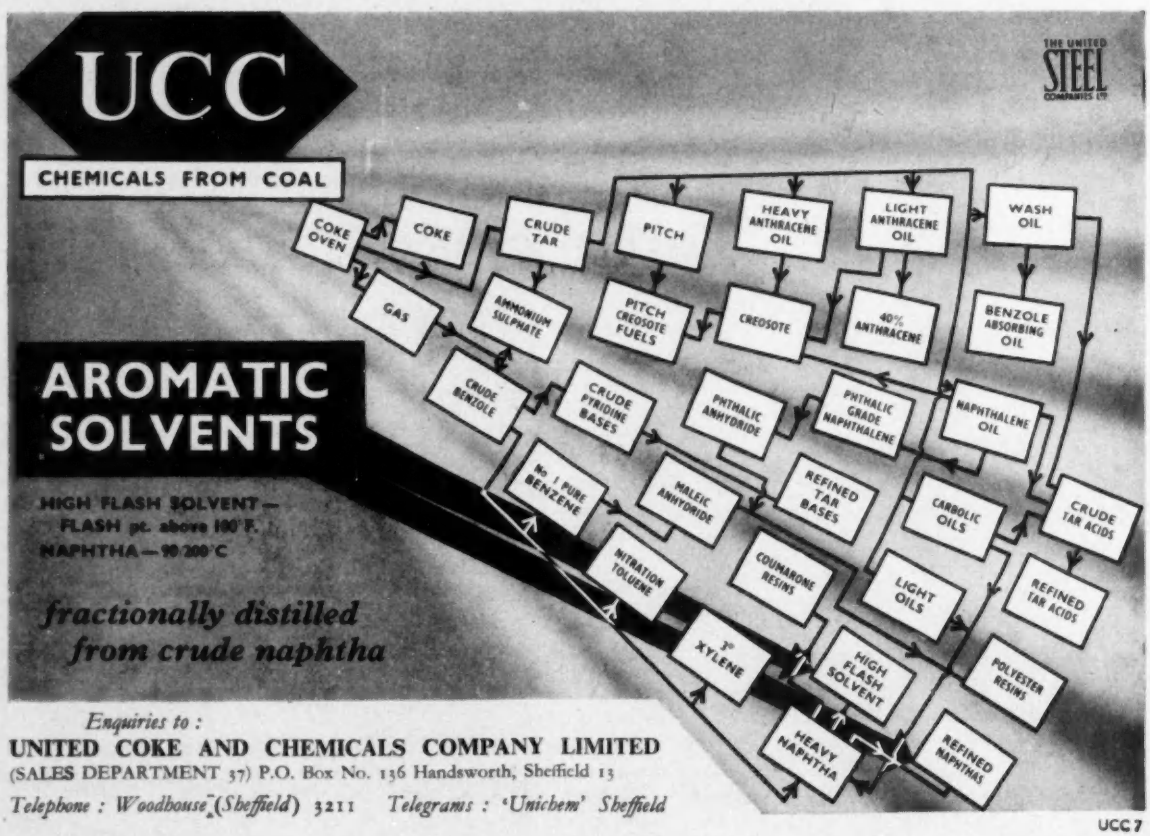

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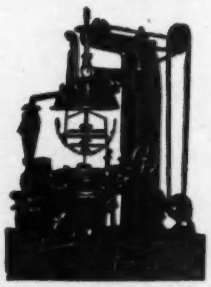

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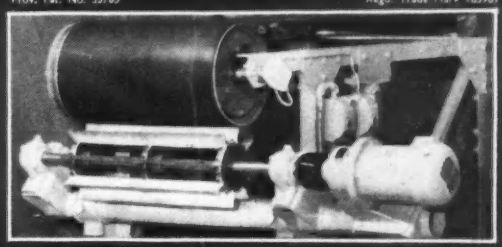

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